APPENDIX C



A STREAM RESTORATION PLAN FOR A PROPOSED SURFACE MINE NEAR SUGAR BRANCH, KNOTT COUNTY, KENTUCKY (APPLICATION No. 860-0380, A. No. 6)

Prepared for:
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&
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Apogee Project # 05-104:00

March 2006



Letter of Transmittal

Attention:

Mr. Darvin Messer

USACE

845 Sassafras Creek Road Sassafras, KY 41759-8806

| DATE | PROJECT # | DELIVERED VIA: | SUBMITTED BY: | RECEIVED BY: |
|---------|-----------|----------------|---------------|--------------|
| 7/12/06 | 05-104.00 | Hand | Joel Beverly | |

| QTY. | DESCRIPTION |
|------|--|
| | A STREAM RESTORATION PLAN FOR A PROPOSED SURFACE |
| | MINE NEAR SUGAR BRANCH, KNOTT COUNTY, KENTUCKY |
| 6 | (APPLICATION No. 860-0380, A. No. 6) |

Dear Mr. Messer,

Please find enclosed a stream restoration plan for a proposed surface mine near Redfox, Knott County, Kentucky (Application No. 860-0380, A. No.1). The applicant (Nally & Hamilton Enterprises, Inc.) requests that this plan be considered by the USACE for a Nationwide 21 Permit. If you should have any questions or comments concerning this project, please feel free to contact me at my office.

Sincerely,

Joel Beverly

Director of Environmental Services

CC: Mr. Rusty Roberts, Logos Engineering, Inc. (Letter of Transmittal)

Mr. Les Williams, Nally & Hamilton Enterprises, Inc. (1 copy)

File (1 copy)

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1.0 INTRODUCTION

Apogee Environmental Consultants (Apogee) was contracted by Logos Engineering, Inc. to prepare a post-mining stream restoration plan for three streams in Knott County, Kentucky. The proposed mine by Nally & Hamilton Enterprises, Inc. [Department of Natural Resources (DNR) Permit No. 860-0380, A. No. 6] and the associated streams to be disturbed are shown in Figure 1. This plan is hereby submitted to U. S. Army Corps of Engineers (USACE) on behalf of Logos Engineering, Inc. and Nally & Hamilton Enterprises, Inc to fulfill the requirements set forth by USACE concerning Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

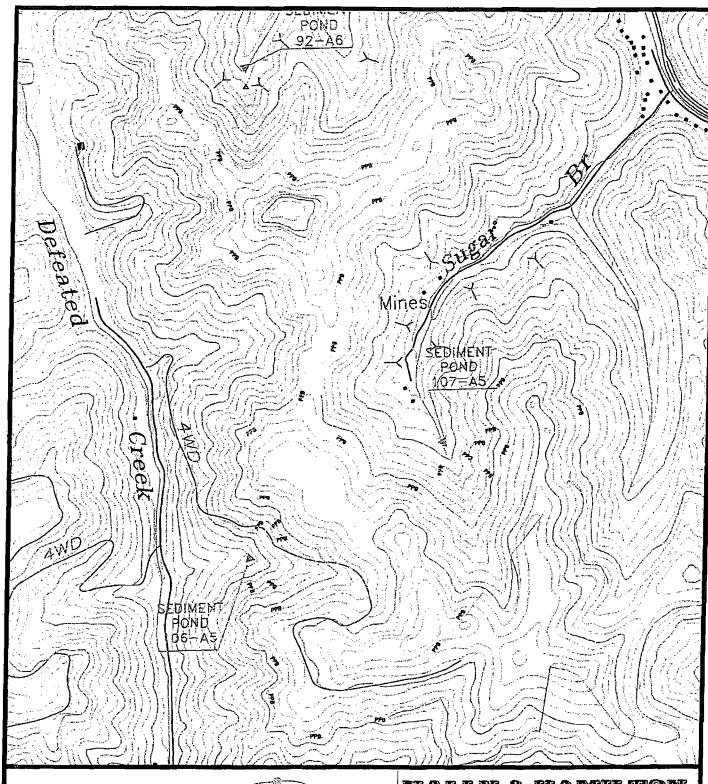
2.0 SITE LOCATION AND DESCRIPTION

The project area is located in Knott County, Kentucky, approximately 1.0 miles southwest of the community of Redfox (Figure 1). The proposed permit area, which is situated on the ridges, slopes and hollows, between Sugar Branch and Defeated Creek, covers approximately 214.5 surface acres. There will be three hollow fills (hollowfills No. 15, 16, and 17) and three associated sediment control ponds (sediment ponds 106, 107, and 92) for the proposed permit that will impact waters of the United States. Hollowfill No. 15 and sediment control pond No. 106 are located in an Unnamed Tributary to Defeated Creek, Hollowfill No. 16 and sediment control pond No. 107 are located in the headwaters of Sugar Branch, and Hollowfill No. 17 and sediment control pond No. 92 are located in the headwaters of and unnamed tributary to Carr Creek Lake. Defeated Creek also flows into Carr Fork Lake while Sugar Branch flows into Breeding Creek. All three affected stream sections are small (1st order) and are located within the North Fork Kentucky River drainage system. All three affected stream sections have intermittent and ephemeral sections.

2.1 Direct and Indirect Impacts

Hollow fill No. 15 will impact 1,729 feet of stream while Sediment Structure No. 106 will impact 112 feet of stream. Hollow fill No. 16 will impact 1,839 feet of stream while Sediment Structure No. 107 will impact 135 feet of stream. Hollow fill No. 17 will impact 684 feet of stream while Sediment Structure No. 92 will impact 105 feet of stream. It is expected that approximately 0.53 acres of waters of the U.S. will be impacted during project operations. The drainage areas above







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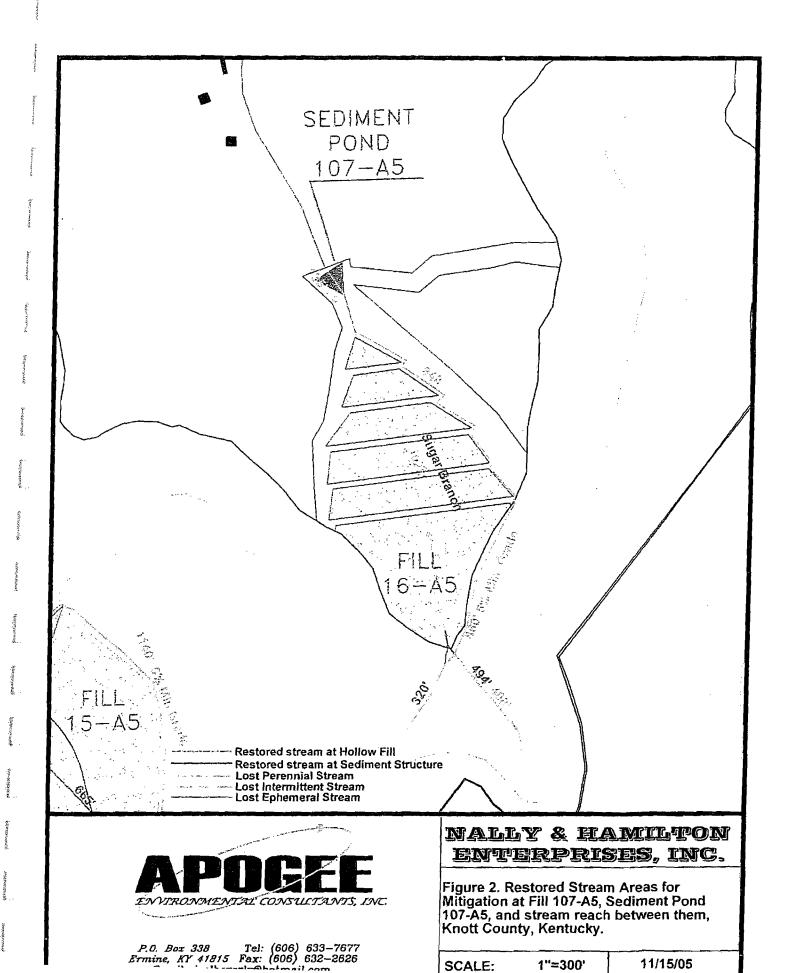
nally & Hamilton Enterprises

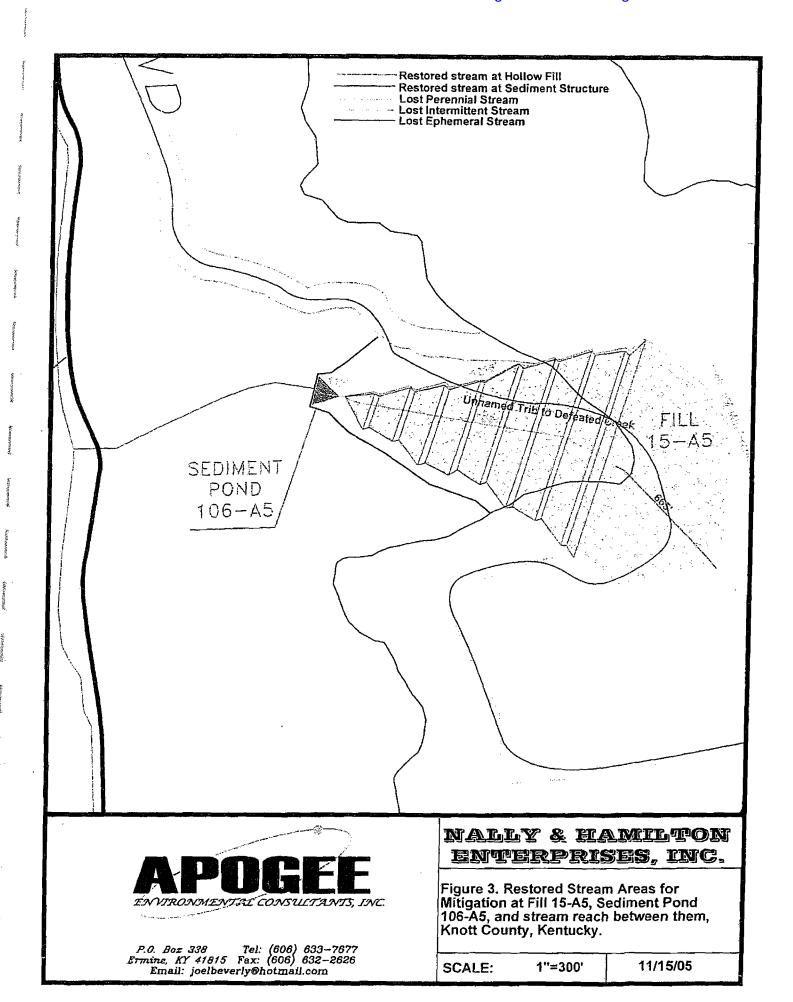
Figure 1. Proposed Surface Mine, Hollowfill, Pond, and Biological Assessment Sites.

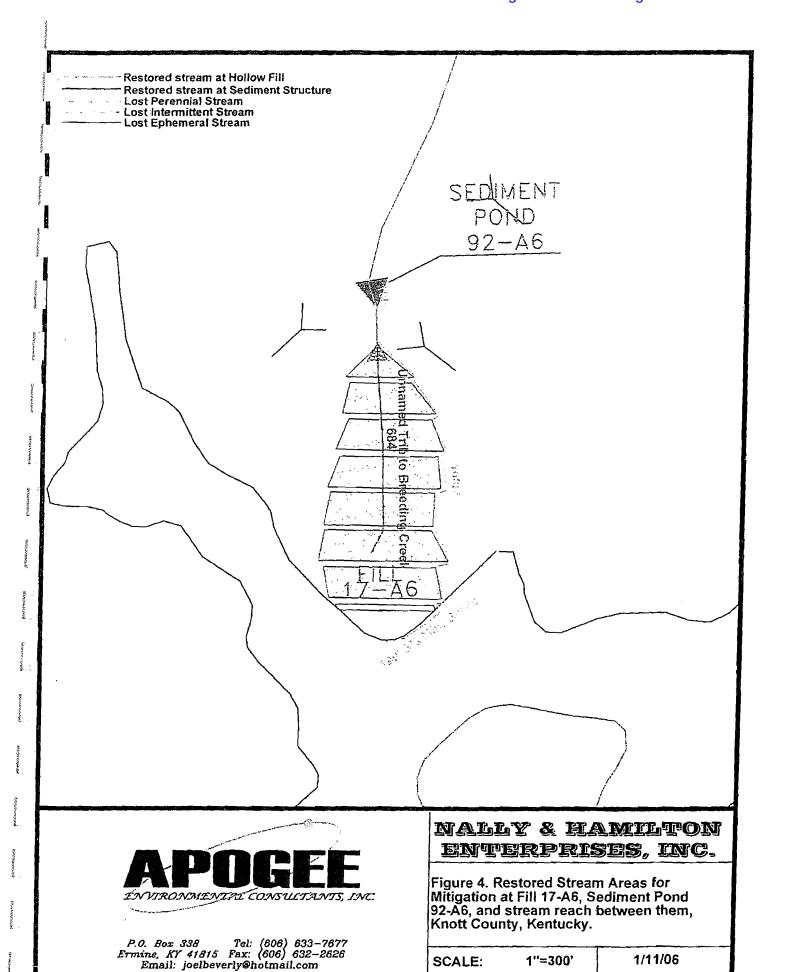
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the toe of hollowfills No. 15, 16, and 17 are 67, 64, and 33 acres respectively. The drainage areas above the dams of sediment structures No. 106, 107, and 92 are 69.8, 66.5, and 35.9 acres respectively. Approximately 1,245,596, 1,243,772, and 1,868,113 cubic yards of fill material will be placed into hollowfills No. 15, 16, and 17 respectively. There will be no impacts to wetlands during the proposed mine project. Direct impacts are illustrated in Figures 2, 3, and 4. No indirect impacts are planned for the project.

Features which might create adverse surface water conditions are existing roads, previous logging operations, existing gas wells, and previous mining operations. No other conditions are known to exist in the watershed which may create any adverse surface water conditions. With the exception the above disturbances, the drainages are completely forested. The proposed project area is located on the Blackey USGS quadrangle.

2.2 Physiography

The project area is situated in the Dissected Appalachian Plateau Ecoregion (Woods et al. 2002). The ecoregion is characterized by narrow ridges, deep coves, narrow valleys, and a mostly forested landscape. Forest types in this ecoregion consist of mixed mesophytic in coves and on north- and east-facing slopes, and mixed oak forests in more upland situations and south- and west-facing lower slopes. White oak forests are also common. Overall, forest composition is highly variable, influenced by such factors as aspect, previous land usage, and degree of slope and topographical shading. Many streams in this ecoregion are cool and high gradient; with a substrate commonly consisting of cobble and boulder (riffles are common). The underlying geology consists of Pennsylvanian shale, siltstone, sandstone, and coal. The presence of coal mining (and also logging and gas exploration) has led to many streams being degraded. Nutrient levels in streams are low, a result of the areas low population, limited farming, and non-carbonate rocks.

2.3 Purpose of Project

2.3.1 Method of Operation

This application proposes surface mining of the area shown on the attached maps. Mining is expected to begin within two months of the final issuance of the permit.

Removal of overburden and coal will be conducted by conventional surface mining methods. Equipment utilized will consist primarily of drills, dozers, loaders, and trucks. Drills (RDC-16) will assist in the blasting of material, with dozers (155 KOMATSU) and loaders (988 CAT) moving the overburden. Trucks (769 CAT) will be used if necessary to transport material to storage areas.



Initially, organic material will be removed before topsoil can be stockpiled. All trees and brush will be windrowed on the solid berm. Since small underbrush, weeds, grasses, and a few small trees are the only forms of organic matter present, non-woody organic matter may be mixed with overburden materials where no stability problems will be created.

All topsoil will be removed and stockpiled or immediately redistributed on a regarded area. Complete procedures for handling topsoil are described in the topsoil handling plan. If topsoil is not redistributed within thirty days, the stockpile will be seeded to prevent erosion, etc.

Once topsoil has been removed from a site, overburden removal will begin. As stated previously, loaders, trucks, and dozers will transport material from the coal removal pit. Coal will then be removed following overburden removal. Coal removal from each pit should not exceed two weeks under normal conditions. However, variables such as weather and equipment breakdowns may cause additional delays. In no case will the highwall created from each individual pit be left unreclaimed for more than 60 days from initial disturbance.

Backfilling will be an automatic process. After coal has been removed from the pit area, overburden from the next proposed coal extraction point will be transported to reclaim behind the preceding operation. This operation proposes to have multiple pits (5 maximum) open simultaneously to allow coal haulage on a continuous basis. However, no more than 1500' of total collective highwall will be exposed at any one time. This is necessary to fulfill contract obligations with the purchaser. However, coal removal in a given location shall be completed within sixty (60) calendar days after the initial surface disturbance at that location. Backfilling and grading to approximate original contour shall follow coal removal by not more than sixty (60) days and by not more than 1500 linear feet. Final grading will ensure that all highwalls are eliminated. The area will be compacted by several passes on each layer with the use of heavy equipment.

Following final grading of slopes, topsoil will be reapplied. Care will be taken to prevent compaction of this material. The area will then be seeded and mulched according to the revegetation plan. Any eroded gullies will be regraded, reseeded, and stabilized or rip-rapped.

2.3.2 Bench Pond Construction

Bench ponds will be constructed per enclosed designs at locations shown on the MRP map. However, bench ponds will not be constructed until mining has progressed through the pond location and any coal within the pond location is removed. Prior to pond construction, mining on the bench in a particular watershed will contain all the water in the pit until the pond area has been mined through and the pond constructed. Since the size of the pit will exceed the pond



size, water holding capacities will exceed those of the pond, thereby, providing adequate sediment control. In no case will runoff be allowed to leave the permitted area without first passing through a certified sediment facility. Bench ponds will be built on lowest coal seam to be mined.

2.3.3 Drainage Corridors

Drainage corridors will be permitted between the mining/storage area and the sediment pond proposed. As shown on the enlarged MRP map, the corridor will include the drainage channel and on area adjacent to the channel for access. Total width is proposed at 30 feet. This includes approximately 10 feet for the drainage channel and areas adjacent to it for any mitigation that might arise, and 20 feet to allow equipment access. However, damage to drainage ways is not expected if design plans within the application are followed.

2.3.4 Best Management Practices

This proposed operation intends to use the best management practices available to ensure protection of the lower lying streams and the associated areas. Erosion will be minimized by immediate seeding, mulching and revegetating of disturbed areas including ponds and outslopes. Hay checks will be placed in areas where erosion gullies or concentrated flows may occur. During pond construction, hay checks will be placed below the disturbance to filter initial disturbance runoff. Likewise, hay checks will be used if necessary along roadway ditches or any temporary ditches or drainage channels created. Rip-rap will be used when velocities or volume of runoff dictates. Throughout the mining process, care will be taken to minimize erosion and protect surface and groundwater quantity and quality. Measures will be taken, as conditions dictated, to prevent adverse effects to the area.

2.4 Project Timeline

Mining will begin immediately or very soon after approval is received from the USACE. The life of each mine permit will vary depending on the amount of coal that can be economically mined from each permit. Economic mineability will depend upon the sales price of coal and, thus, a definite length of mining is hard to define. Despite the unknowns, mining operations are expected to last for approximately 3 years.

3.0 SURVEYS CONDUCTED

Several site visits by personnel from Apogee have been made to determine the existing conditions at the three streams that will be impacted during mine operations. This information will guide restoration efforts and will be used to determine if these efforts are a success.



3.1 Aquatic Biological Assessment

The two unnamed tributaries were visited on 10 November 2005 to conduct an aquatic biological assessment. However, due to the streams flowing at such a low level, benthic sampling was not conducted.

3.1.1 Habitat Assessment

The method used to analyze habitat followed Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish (2nd Edition) (Barbour et al. 1999). Sample sites were visited on 2 and 14 December 2005 and 8 January 2006 by Apogee biologists, with stream conditions and riparian vegetation being recorded at each site. Stream conditions at each site were assessed using the High Gradient Stream Data Sheet (Barbour et al. 1999). The following stream condition parameters were assessed at each site: available cover, embeddedness, velocity/depth regime, sediment deposition, channel flow status, channel alteration, frequency of riffles (or bends), bank stability, vegetative protection, and riparian vegetative zone width. The completed data sheets for each site can be found in Appendix A. Riparian vegetation was analyzed using DSMRE's constructed vegetative stratum rank system (Appendix B). Results of the vegetation survey are shown in Table 1.

Table 1. Vegetation analysis using DSMRE's Constructed Vegetative Stratum Rank System at three streams in Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| Liriodendron tulipifera | SS #106 | SS #107 | |
|----------------------------|--|--|---|
| Liriodendron tulipifera | | | SS #92 |
| | 5 | 6 | 7 |
| Tsuga canadensis | 8 | | |
| Platanus occidentalis | 5 | | 1 |
| Magnolia tripettala | 1 | 2 | 1 |
| Betula lenta | 2 | | 2 |
| lack Gum Nyssa sylvatica | | 4 | |
| Fagus grandifolia | 4 | 6 | 5 |
| Cornus floridus | 1 | | 1 |
| Basswood Tilia Americana | | 1 | 2 |
| Amalanchier arborescens | 2 | | |
| Quercus velutina | | 7 | |
| Sugar Maple Acer saccharum | | 4 | 2 |
| Acer rubrum | | 4 | |
| | Magnolia tripettala Betula lenta Nyssa sylvatica Fagus grandifolia Cornus floridus Tilia Americana Amalanchier arborescens Quercus velutina Acer saccharum | Magnolia tripettala1Betula lenta2Nyssa sylvatica2Fagus grandifolia4Cornus floridus1Tilia Americana1Arnalanchier arborescens2Quercus velutinaAcer saccharum | Magnolia tripettala12Betula lenta24Nyssa sylvatica24Fagus grandifolia46Cornus floridus11Tilia Americana11Arnalanchier arborescens27Quercus velutina7Acer saccharum4 |



| Common Name | Latin Name | HF #15 and SS #106 | HF #16 and SS #107 | HF #17 and SS #92 |
|------------------|-----------------------|-----------------------|-----------------------|----------------------|
| Cucumber Tree | Magnolia accuminata | · | 1 | |
| Shagbark Hickory | Carya ovata | | 4 | |
| Black Locust | Robinia pseudoacacia | | | 1 |
| Sourwood | Oxydendron arboreum | | | 2 |
| Yellow Buckeye | Aesculus flavus | | | 3 |
| Spice Bush | Lindera benzoin | | | 1 |
| Hydrangea | Hydrangea arborescens | | | 1 |

3.1.2 Physiochemical

Measurements were taken for specific conductance during the 2 and 14 December 2005 and 8 January 2006 site visits. Conductivity levels for hollowfills No. 15, 16, and 17 were 410, 270, and 368 respectively.

3.2 Physical Characteristics

Based upon Rosgren's (1994) classification system, stream sections at hollowfills 15, 16, and 17 are considered A3a+, while the stream sections at sediment structure 106, 107, and 92 are considered A3. Both stream types are characterized by having high entrenchment, high gradient (>10 % slope for A3a+ streams and between 4 and 10 % slope for A3 streams), low sinuosity, and a substrate consisting mostly of cobble. The areas of stream to be impacted were assessed using the High Gradient Stream Data Sheet. The streams were in poor condition and thus scored very low (Appendix A). Based upon the streams being in such poor condition, a stream of similar size, but in better condition, was surveyed to get stream pattern, profile, and dimensions to help guide stream restoration efforts. The results of this assessment are located in Table 2. The completed data sheets for longitudinal profiles, pebble counts, and cross sections are located in Appendix C. Longitudinal profiles, cross sections, and pebble counts were also surveyed at all proposed disturbed streams to show current conditions (Appendix D).



Table 2. Stream pattern, profile, and dimension data at unnamed tributary to Carr Creek Lake that will be used to guide restoration efforts at three streams in Knott County, Kentucky.

| Characteristic | Score | | | | | |
|-----------------------|----------|------------|--|--|--|--|
| | HF Areas | Pond Areas | | | | |
| Pattern | | | | | | |
| Sinuosity | 1.22 | 1.17 | | | | |
| Profile | | | | | | |
| Slope | 20.9 | 10.2 | | | | |
| Dimension | | | | | | |
| Bankful Width (ft) | 5.9 | 8.0 | | | | |
| Mean Depth (ft) | Dry | .3 | | | | |
| Maximum Depth (ft) | Dry | 1.8 | | | | |
| Bankful Depth (ft) | 1.5 | .85 | | | | |
| Width/depth Ratio | 3.9 | 9.4 | | | | |
| Floodprone width (ft) | 9.3 | 12.6 | | | | |
| Entrenchment Ratio | 1.6 | 1.6 | | | | |

4.0 IMPACTS TO STREAM

4.1 Alternatives Analysis

To ensure that as little stream as possible is impacted, a number of changes have been made to the original engineering plans. Plans had originally called for the construction of sediment ponds farther downstream from each hollowfill. However, after discussing these plans, the client decided to move the sediment control structures as close as practical to the toe of the hollow fills.

To completely ensure that the client is taking the appropriate action concerning waters of the U.S., other options were also considered. Using deep mines instead of area and auger mining techniques were considered. However, deep mining would result in limited resource recovery and would not discourage potential future mining in the same area. Also, due to the area being previously affected by pre-law mining, current proposed activities will remove high wall areas and restore the topography to a more natural slope.

Other options considered included the possibility of using upland areas for the storage of waste materials and also using only two hollowfills. However, both of these alternatives were not viable due to the amount of excess material to be disposed of. Due to the large amount of waste material, it is not practical to



place this material in upland areas. Optimally, this amount of fill could be placed in two hollowfills, however, if only two hollowfill were used, this would lead to more fill being placed into intermittent streams than is proposed in the current work plan. In addition, the three streams that will have hollowfills located in them have been heavily disturbed by past mining. Based upon this, it was not thought that using these streams would greatly impact overall water quality in the area.

Therefore, three hollowfills are proposed, one each on the three stream sections to be disturbed during mining activities. Neither of the streams to be impacted is considered to be a high quality stream, as indicated by the above surveys conducted. Before disturbance is to begin upstream, Ponds 106, 107, and 92 will be constructed to provide sediment control measures for each of the drainages.

4.2 Stream Assessment

The streams were assessed using the Ecological Integrity Index (EII) and Ecological Integrity Units (EIUs) developed by USACE (Table 3). EII is measured as quality per running foot and is scored from 0 – 1 (with 1 being equal to least disturbed conditions in the region). Ecological Integrity Units are calculated by multiplying the EII by length of stream to be impacted (in feet) (Table 1).

Table 3. Stream lengths, Ecological Integrity Index (EII), and Ecological Integrity Units (EIUs) at three streams in Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| Impact Reach Name | Stream Length (ft) | EII | EIU | |
|-------------------------------|-----------------------|-----|-------|--|
| Hollowfill #15 (ephemeral) | 665 | .20 | 133 | |
| Hollowfill #15 (intermittent) | 1,064 | .20 | 212.8 | |
| SS #106 (intermittent) | 112 | .20 | 22.4 | |
| Hollowfill #16 (ephemeral) | 814 | .38 | 309.3 | |
| Hollowfill #16 (intermittent) | 1,025 | .38 | 389.5 | |
| SS #107 (intermittent) | 135 | .39 | 52.7 | |
| Hollowfill #17 (ephemeral) | 684 | .25 | 171 | |
| SS #92 (intermittent) | 105 | .25 | 26.3 | |
| Total | 4,604 | | 1,317 | |



4.3 Cumulative Impacts Analysis

In addition to the proposed direct affects on the streams, the incremental impact of the proposed activities when added to other past, present and reasonably foreseeable future actions were also taken into account. Future land disturbances that could potentially occur in the drainages include logging operations and powerline corridor development. It is unlikely that there will be any agricultural development or road construction, due to the hollows being so small, steep, and remote. It is also unlikely that additional mining activities will occur in the drainage after current proposed activities are concluded.

In addition to the above potential future land disturbance activities, there will also be some watershed improvement projects. The proposed streams that will be affected during this project have been heavily impacted by past mining. Past mining areas that are located below the toe of the proposed hollowfills will be restored as closely as possible to a healthy stream system. In addition to the stream sections below the toe of the hollow fill, natural stream sections will also be constructed on both sides of each hollowfill.

5.0 STREAM RESTORATION PLAN

Once all mining activities are completed, the streams will be restored as closely as possible to a healthy stream system. All three streams to be impacted are of very low quality, and thus are not a good guide to restoring the streams. Therefore, a similar size, higher quality stream was surveyed. The results of this survey will guide restoration efforts.

The purpose of this restoration plan is to return stability and ecological function to the impacted streams, while also making the streams self-maintaining. The pattern, profile, and dimension data collected at the high quality stream site will be used to guide the stream restoration efforts. Restoration measures to be employed include stream shaping and realignment, revetments (riffles, boulder clusters, substrate, cover logs, J-hook vanes, and cross vanes), and bioengineering (revegetation).

All sediment control ponds will be removed and each stream restored to a self-maintaining system, while hollowfills will have natural channels constructed on the sides of each (Figures 2, 3, and 4). During the removal of the sediment control ponds, silt fences and/or rows of straw will be employed to reduce the amounts of sediment that will impact the downstream areas. All stream restoration efforts will be conducted during low flow situations.



5.1 Stream Habitat

Current in-stream habitat is not in a natural, self-maintaining condition. All three streams have been impacted by previous mining and logging operations. The streams at proposed hollowfills No. 15 and 17 have old sediment control structures located in them (proposed sediment control structures will be located in the same spot as existing sediment structures) while the stream at proposed hollowfill No. 16 has been heavily affected my logging. Due to these disturbances, we surveyed a more natural, similar size stream located off-site to guide restoration efforts.

During restoration efforts, in-stream habitat will be re-created as closely as possible to a natural stream channel (following data collected at the off-site stream). This will include reproducing as closely as possible the bankfull width, depth, channel sinuosity, riffle-run-pool ratio, and substrate types. The longitudinal profile (riffle/run/pool), cross sections, and pebble count data collected will be used to guide restoration efforts. A diverse in stream habitat will be achieved by using rock/log deflectors, riffles, boulder clusters, substrate (cobble and gravel), cover logs, J-hook vanes (made of large rock, logs, and/or root wads), and cross vanes (rock and log). These structures will help make the stream self-maintaining and also provide a diverse habitat for aquatic organisms. During the construction phase, data sheets detailing current conditions should be referred to to ensure that restoration efforts are being created as closely as possible to pre-disturbance conditions.

In stream restoration structures will be placed in such a way to create a self-maintaining stream. Where bends in the stream are proposed, J-hook vanes will be placed to stabilize the banks and to form a scour pool in the center portion of the channel (Attachment 1). Placing the J-hook vanes in the stream bends will help dissipate energy during high flow situations. The vane arm sections of the J-hook vanes (near the bank) will be interlocked with no spaces in between, thus stabilizing the banks as much as possible. These structures should be built at a 20 to 30 degree angle from the bank. The center sections of the J-hook vanes (that jut out into the middle of the stream) will have gaps located in between the large rocks. These gaps will help transport sediment and improve channel capacity and sediment competence. The vane arm section of the J-hook should be one-third the bankful width of the stream channel and the center section should cover another one-third. Footers for these structures should be three times the protrusion height of the invert rock.

Where sections of the stream are currently straight, cross-vanes will be placed to help provide pool/run habitat. These structures will decrease stream velocity and power near the bank and increase it near the center. Cross vanes will be constructed of either logs or boulders (Attachment 2 and 3). Logs used for these cross vanes will have a 12 to 18 inch diameter and will be at least 18 feet long.



To ensure that the logs will not be washed out during high flow situations, log ends will be buried at least two feet within each bank. Cross vanes constructed of boulders will have footers that are three times the protrusion height of the invert rock. The arm vane arm structures should be built at a 20 to 30 degree angle from the bank. Bankfull levels will be approximately six inches above cross vane structures. These structures will be constructed approximately five to seven bankfull widths of each other.

In areas that are currently occupied by step pools, interlocking cross-vanes will be placed to mimic as closely as possible the pre-disturbance conditions (Attachment 4). These structures will also help dissipate energy during high flow situations and will provide small pockets of deep water habitat for aquatic organisms.

In addition to the stream sections below the toe of the hollow fill, natural stream sections will also be constructed on both sides of each hollowfill. The sides of these drainages will be rip-rapped while the inside sections will have a natural stream channel design. Although there will be drainages down both sides of the hollowfills, the flow of water will be concentrated into only one of these stream sections as to ensure the highest water flow throughout the year. These restored sections will be constructed on solid ground near where the hollow fill comes in contact with the natural terrain. This will help ensure that water does not sink into the fill area but instead flows above ground. In addition, the tree line should come very close to the side of each hollow fill and help to create a more natural setting more quickly. Cross-vanes (made of logs) will be placed in these sections of restored stream to help provide pool/run habitat and to help create a system that is self-maintaining.

In addition to the above listed restoration methods, the restoration will utilize small boulders, cobble, and gravel to mimic as closely as possible the current conditions of the healthy stream. These will help give the stream a natural look and will provide habitat for aquatic organisms. Rock used for the restoration efforts will be a durable sandstone obtained on-site during project operations.

5.2 Riparian Habitat

Once the stream restoration efforts are complete, the riparian vegetation will be re-established. This riparian vegetation will help prevent sedimentation of the streams, keep water temperatures cool (by shading), and provide nutrients for organisms that live within the stream. Mesic-hydric and hydric shrubs will be planted between the normal flow and bankfull areas. This riparian zone will be 60 feet wide on both sides of the stream. During the revegetation process, the site will have hydromulch applied. The hydromulch will aid in the retention of water and help prevent the site from becoming excessively dry. As this mulch decays it will also build additional topsoil.



5.2.1 Grasses

The site will be seeded with temporary groundcover, legumes and permanent grass. The temporary plants to be seeded will include either foxtail millet (Setaria italica), annual rye (Lolium multiflorum), or winter cereal rye (Secale careale). To insure seeding and to diversify the temporary vegetation, a combination of these species may be used. During seeding a species of legume [white clover (Trifolium repens)] will be selected to achieve nitrogen fixation in the soil and to provide quick growing ground cover. In addition to temporary plants and legumes, two species of permanent grasses will be seeded to help build topsoil and to provide quick soil cover. The grasses to be seeded will be a combination of little blue stem (Schizachyrium scoparium); redtop (Agrostis alba), and little blue stem; or orchard grass, redtop, and little blue stem. See Table 4 for seeding rates for the grasses, legumes, and temporary plants.

Table 4. Seeding rates for grasses, legumes, and temporary plants at proposed permit area, Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| Types of Plants and Common Name | Rate per Acre |
|---------------------------------|---------------|
| Permanent Grass | |
| Redtop Grass | 3 lbs |
| Little Blue Stem | 3 lbs |
| Legume | |
| White clover | 3-5 lbs |
| Temporary Plants | |
| Foxtail Millet | 5-10 lbs |
| Annual Rye | 15-20 lbs |
| Winter Cereal Rye | 15-20 lbs |

5.2.2 Trees

Native species of trees that are currently known from the site should be used whenever they are available from the Kentucky Division of Forestry and Nurseries. The exact species of trees to be used will be determined at a later time and will depend on availability. However, at least three species each of trees and shrubs should be used to revegetate the riparian areas. A total of 500 stems per acre will be planted as part of the revegetation plan (350 trees and 150 shrubs). Revegetation will be considered a success if after five years there are 300 stems per acre of live trees and shrubs (200 trees and 100 shrubs). Both trees and shrubs should be planted between three and six feet from each other. This will help ensure that enough vegetation is planted to get the benefits of the riparian habitat, without the vegetation being too densely packed. Trees planted will be bare root stock. In addition to planted species, the site will probably have some native volunteer species invade. Table 5 lists recommended tree species for revegetation of the riparian areas.



Table 5. Recommended tree species for revegetation of riparian areas, Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| Common Name | Scientific Name | Hydrologic Regime |
|-----------------------|-------------------------|-------------------------|
| Tree Species | | |
| Silver Maple | Acer saccharinum | Mesic |
| Sugar Maple* | Acer saccharum | Intermediate Mesi/Xeric |
| Yellow Birch | Betula alleghaniensis | Mesic |
| Sweet Birch* | Betula lenta | Mesic |
| Tulip Tree* | Liriodendron tulipifera | Mesic |
| Sweet Gum | Liquidambar styraciflua | Hydric |
| Sycamore* | Platanus occidentalis | Mesic-Hydric |
| Basswood* | Tilia americana | Mesic |
| Northern Red Oak | Quercus rubra | Mesic |
| American Elm | Ulmus americana | Mesic-Hydric |
| Red Elm | Ulmus rubra | Mesic-Hydric |
| Eastern Hemlock* | Tsuga canadensis | Mesic |
| Shrub Species | | |
| Alder | Alnus serrulata | Hydric |
| Black Willow* | Salix nigra | Hydric |
| Elderberry | Sambucus Canadensis | Mesic-Hydric |
| Ironwood | Carpinus caroliniana | Mesic-Hydric |
| Maple-leaved Vibernum | Vibernum acerfolia | Mesic |
| Witch Hazel | Hamamelis virginiana | Mesic |
| Hydrangea * | Hydrangea arborescens | Mesic-Hydric |
| Spicebush* | Lindera benzoin | Mesic |

 ⁼ Tree and shrub species that are currently growing on the permit area.

6.0 MITIGATION

Under existing law the USACE requires compensatory mitigation to replace aquatic resource functions unavoidably lost or adversely affected by authorized activities. The objective of this mitigation plan is to compensate for adverse conditions associated with the loss of 4,604 feet of stream. To compensate the client will do on-site mitigation and also pay an in-lieu-fee.

6.1 Mitigation Work Plan

Mitigation for the sediment structures will be conducted within the degraded streambeds, while mitigation for the the hollowfills will be conducted by constructing natural stream drainages on the sides. Linear feet restored for the



ponds will be equal to pre-disturbance levels. There will be one drainage at the top of each hollowfill and one drainage down each side. Figures 2-4 and Table 6 illustrate the drainage lengths that will be used for mitigation purposes. Only a single side drainage of the hollowfills will be used for mitigation requirements. The top drainage of each hollowfill will be sloped toward the side to be used for mitigation to ensure that as much water as possible gets to the drainage used for mitigation. The top drainage of the hollowfills will be constructed at a 5 to 7 percent grade (on solid ground) and thus will function as a natural stream. Stream restoration in this section will follow profile and cross section plans that were collected at a stream of similar slope (Appendix E).

Based upon losses and gains at the project site, the client will need to offset the net loss of 1,955 feet (Table 6). To accomplish this, the client has agreed to pay an in-lieu-fee. Based upon the loss of 1,955 feet of stream, the client will need to pay an in-lieu-fee of \$291,600.00. This money will go to satisfy compensatory mitigation requirements and help meet the USACE's goal of no overall net loss of waters of the U.S. In-lieu-fee calculations are summarized in Table 7. The Stream Compensation Ratio Calculator forms that were used to calculate mitigation amounts are located in Appendix F. EII Calculation Spreadsheets for pre-disturbance, immediately after disturbance, and 30 years after disturbance are included in Appendices G, H, I. A summary of these data sheets is located in Table 8. Mitigation in these streams will follow restoration plans outlined in Section 5.0. Pictures of the streams are included with the EII Data Spreadsheets in Appendix G.

Restoration efforts will proceed as soon as mining operations have concluded. After restoration, certain habitat features will recover quickly while others will take time to mature. Both vegetative protection and riparian width will take time to come back, while the other eight parameters should come back more quickly (and in some instances even exceed pre-disturbance levels).

6.2 Site Protection

No site protection is proposed for the restored stream areas. To account for this, the risk factor used in the stream compensation ratio calculator, which is set at 20 percent for most projects, was set at 50.



Table 6. Stream compensation ratio calculator for proposed mitigation efforts at three streams in Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| Impact Reach Name | imp | Mitigation Site | | | | | | | | | | |
|-------------------------------|--------|-----------------|-------------|----------------------------|--------|-------------|--------------|----------------------|-------------------|--------------------|-------------------|---------|
| , | | | | Mitigation Timing and Risk | | Ell | | | Mitigation (feet) | | eet) | |
| | Length | Pre Ell | Post Ell | Start | Mature | Risk (%) | Pre- work | Immediately After | At Maturity | Length Required | Length Offered | Balance |
| Hollowfill #15 (ephemeral) | 665 | .20 | 0 | 2010 | 2040 | 50 | 0 | .32 | .37 | 386 | 386 | 0 |
| Hollowfill #15 (intermittent) | 1,064 | .20 | 0 | 2010 | 2040 | 50 | 0 | .32 | .37 | 739 | 72 | 930 |
| SS #106 (intermittent) | 112 | .20 | 0.1 | 2010 | 2040 | 50 | 0.1 | .38 | .43 | 39 | 39 | 0 |
| Hollowfill #16 (ephemeral) | 814 | .38 | 0 | 2010 | 2040 | 50 | 0 | .30 | .35 | 953 | 953 | 0 |
| Hollowfill #16 (intermittent) | 1,025 | .38 | 0 | 2010 | 2040 | 50 | 0 | .30 | .35 | 1,025 | 0 | 1,025 |
| SS #107 (intermittent) | 135 | .39 | 0.1 | 2010 | 2040 | 50 | 0.1 | .38 | .43 | 136 | 135 | 0 |
| Hollowfill #17 (ephemeral) | 684 | .25 | 0 | 2010 | 2040 | 50 | 0 | .30 | .34 | 535 | 535 | . 0 |
| SS #92 (intermittent) | 105 | .25 | 0.1 | 2010 | 2040 | 50 | 0.1 | .30 | .34 | 76 | 76 | 0 |
| Total | 4,604 | | | | | | | | | | | 1,955 |

[•] All mitigation will occur at the site of disturbance.

Table 7. In-lieu fee summary at three streams in Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| • | | | | , , | |
|-------------------------------|-----------------------------|-----|-------|-------------------------------------|--------------|
| Impact Reach Name | Stream Length Balance | EII | EIU | Compensatory Mitigation Ratio | In-Lieu Fee |
| Hollowfill #15 (ephemeral) | 0 | .20 | 0 | | 0 |
| Hollowfill #15 (intermittent) | 930 | .20 | 186 | 1.13 | \$125,550.00 |
| SS #106 (intermittent) | 0 | .20 | 0 | - | 0 |
| Hollowfill #16 (ephemeral) | 0 | .38 | 0 | - | 0 |
| Hollowfill #16 (intermittent) | 1,025 | .38 | 389.5 | 1.35 | \$166,050.00 |
| SS #107 (intermittent) | 0 | .39 | 0 | <u> </u> | 0 |
| Hollowfill #17 (ephemeral) | 0 | .25 | 0 | | 0 |
| SS #92 (intermittent) | 0 | .25 | 0 | - | 0 |
| Total | 1,955 | | 575.5 | | \$291,600.00 |

Table 8. Individual habitat assessment parameters for hollowfills No. 15, 16, and 17 and sediment structures No. 106, 107, and 92 for present day, immediately after restoration, and 30 years after restoration, Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| Site | Time Period | | Parameter | | | | | | | | | | | | |
|--------|-----------------|------------------------|--------------|--------------------------|------------------------|------------------------|-----------------------|----------------------|-------------------|--------------------------|-------------------|-----|--|--|--|
| | | Epifaunal Substrate | Embeddedness | Velocity/Depth Regime | Sediment Deposition | Channel Flow Status | Channel Alteration | Frequency of Riffles | Bank Stability | Vegetative Protection | Riparian Width | | | | |
| HF 15 | Pre-disturbance | 4 | 6 | 5 | 6 | 2 | 2 5 | | 6 | 6 | 4 | 63 | | | |
| | 5 Years | 17 | 17 | 10 | 17 | 2 | 15 | 20 | 18 | 12 | 14 | 142 | | | |
| | 30 Years | 17 | 17 | 10 | 17 | 2 | 15 | 20 | 18 | 14 | 18 | 148 | | | |
| SS 106 | Pre-disturbance | 1 | 1 | 1 | 1 | 10 | 1 | 1 | 8 | 4 | 6 | 34 | | | |
| | 5 Years | 17 | 17 | .10 | 17 | 10 | 15 | 20 | 18 | 12 | 14 | 150 | | | |
| | 30 Years | 17 | 17 | 10 | 17 | 10 | 15 | 20 | 18 | 14 | 18 | 156 | | | |
| HF 16 | Pre-disturbance | 10 | 10 | 9 | 10 | 1 | 9 | 19 | 8 | 10 | 4 | 90 | | | |
| | 5 Years | 17 | 17 | 9 | 17 | 1 | 15 | 20 | 18 | 12 | 14 | 140 | | | |
| | 30 Years | 17 | 17 | 9 | 17 | 1 | 15 | 20 | 18 | 14 | . 18 | 146 | | | |
| SS 107 | Pre-disturbance | 13 | 10 | 10 | 10 | 9 | 9 | 19 | 8. | 10 | 4 | 102 | | | |
| | 5 Years | 17 | 17 | 10 | 17 | 9 | 15 | 20 | 18 | 12 | 14 | 149 | | | |
| | 30 Years | 17 | 17 | 10 | 17 | 9 | 15 | 20 | 18 | 14 | 18 | 155 | | | |
| HF 17 | Pre-disturbance | . 11 | 9 | 9 | 9 | 0 | 12 | 19 | 6 | 10 | 12 | 97 | | | |
| | 5 Years | 17 | 17 | 9 | 17 | 0 | 15 | 20 | 18 | 12 | 14 | 139 | | | |
| | 30 Years | 17 | 17 | 9 | 17 | 0 | 15 | 20 | 18 | 16 | 18 | 145 | | | |
| SS 92 | Pre-disturbance | 10 | 9 | 9 | 9 | 0 | 1 | 16 | 8 | 4 | 6 | 72 | | | |
| | 5 Years | 17 | 17 | 9 | 17 | 0 | 15 | 20 | 18 | 12 | 14 | 139 | | | |
| | 30 Years | 17 | 17 | 9 | 17 | 0 | 15 | 20 | 18 | 16 | 18 | 145 | | | |



7.0 MONITORING

7.1 Monitoring and Long-term Management

Following the implementation of the restoration plan, a professional engineer will certify to the USACE that construction meets or exceeds planned goals. Following successful restoration, the restored areas will be monitored for five years. This monitoring plan will evaluate the success of the mitigation work and will allow for any necessary adjustments to assure the success of the restoration site. Annual monitoring reports will be submitted to the appropriate USACE office no later than 31 December of the year following completion of the restoration efforts. The annual monitoring reports will include an inspectors report and photographs with locations shown on project maps. If during the time that the restored areas are monitored, there are significant failures in the design of the restored streams, a revised mitigation plan will be submitted to fix any shortcomings in the original mitigation plan. If at the end of the five years the restoration efforts are deemed a success, the applicant shall be released from all permit obligations.

Monitoring will consist of grading the restored area yearly using the High Gradient Stream Restoration Sheets (Barbour et al. 1999). The following parameters will be monitored; pH, specific conductance, dissolved oxygen, epifaunal substrate, embeddedness, velocity/depth regime, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, vegetative protection, and riparian zone. Table 9 illustrates success standards and method of determination for each of these parameters.

Table 9. Factors to be considered when determining successful stream restoration, Knott County, Kentucky (Permit No. 860-0380, A. No. 6).

| Parameter/Observation | Success Standards | Method of Determination |
|-----------------------|---|--|
| Field pH | Report Only | Field Meter |
| Specific Conductance | Report Only | Field Meter |
| Dissolved Oxygen | Report Only | Field Meter |
| Epifaunal Substrate | Minimum 70% favorable substrate | Pebble count; Estimate of available |
| Embeddedness | Maximum 20% embeddedness | Pebble count; measure embeddedness |
| Velocity/Depth Regime | Maintain step-pool or riffle-pool sequences similar to approved plans | Longitudinal profile |
| Sediment Deposition | Little or no enlargement of Islands or point bars and <5% of the bottom affected by sediment deposition | Pebble counts in pools |
| Channel Flow Status | Maintain width/depth ratio similar to accordance with plans | Determine from X-sections |
| Channel Alternation | Maintain minimal channelization similar to approved plans | Longitudinal profiles; X-sections |
| Frequency of Riffles | Maintain step-pool or riffle-pool sequences similar to approved plans | Longitudinal profile |
| Bank Stability | Banks stable | Bank Erosion Index; Observe density & depth of plant roots, near bank shear stress |
| Vegetative Protection | Approved width of riparian zone planted with minimum 300 stems/acre surviving | Measure replanted width; estimated stem count |
| Riparian Zone | Riparian zone with a variety of species alive and healthy | Measure replanted width; estimated stem count |

7.2 Financial Assurances

Nally & Hamilton Enterprises, Inc. will assume all responsibility for success at the proposed mitigation site. Based upon this assumption of responsibility, no set aside fund is considered necessary.



8.0 RESPONSIBLE PARTIES

8.1 Applicant

Nally & Hamilton Enterprises, Inc. P.O. Box 157 Bardstown, KY 40004 (606) 878-1500

8.2 Preparer of Restoration Plan

Apogee Environmental Consultants, Inc. (Joel Beverly) P.O. Box 338 Ermine, KY 41815 (606) 633-7677



9.0 LITERATURE CITED

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Appendix A

Completed High Gradient Stream Data Sheets



High Gradient Stream Data Sheet STREAM NAME: DUGGE LOCATION: BASIN/WATERSHED: STATION #: MILE: USGS 7.5 TOPO: LONG.: LAT.: DATE: 4 DEC DS TIME: 4'30 DAM DEPM INVESTIGATORS: TYPE SAMPLE: 0 P-CHEM 0 Macroinvertebrate 0 FISH 0 BACT. WEATHER: Now Past 24 hours Has there been a heavy rain in the last 7 days? θ 9 Heavy rain 0 Yes X No Steady rain Air Temperature ·A °C. Inches rainfall in past 24 hours _____ in. K Intermittent showers X % Cloud Cover θ θ Clear/sunny Cond. 270 P-Chem: Temp(°C) D.O. (mg/l) pH(S.U.) θ Grab %Saturation INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: [od Stream Width R Range of Depth n 0 Surface Mining θ Construction **K** Forest θ Deep Mining 0 Commercial Average Velocity fV5 0 Pasture/Grazing Discharge cfs XOil Wells 0 Industrial 0 Silviculture Est. Reach Length 0 Land Disposal 9 Row Crops 0 Urban Runoff/Storm Sewers Stream Flow: Hydraulic Structures: Stream Type: 9 Dry O Pooled X Low 9 Normal θ Perennial θ Intermittent θ Dams θ Bridge Abutments #Ephemeral 0 Seep 0 Island 0 Waterfalls 0 High 0 Very Rapid or Torrential 9 Other Riparian Vegetation: Dom, Tree/Shrub Taxa Canopy Cover: Channel Alterations: Dominate Type: θ Fully Exposed (0-25%) θ Dredging Trees Shrubs θ Partially Exposed (25-50%) *Channelization 0 Grasses MHerbaccous A Partially Shaded (50-75%) (0Full 0Partial) Number of strata θ Fully Shaded (75-100%) Riffle Substrate 0Est. 0P.C Run % Pool % Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm)Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock Condition Category Habitat Parameter Suboptimal Optimal Marginal Poor Greater than 70% of 40-70% mix of stable 20-40% mix of stable Less than 20% stable habitat; substrate favorable for habitat; well-suited for full habitat; habitat availability lack of habitat is obvious; Epifaunal Substrate/ epifaunal colonization and colonization potential; adequate habitat for less than desirable; substrate unstable or lacking. fish cover; mix of snags, submerged logs, undercut substrate frequently Available maintenance of populations; presence of additional disturbed or removed. Cover banks, cobble or other stable habitat and at stage to allow full colonization substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). potential (i.e., logs/snags that are not new fall and not transient). SCORE 20 19 18 17 15 14 13 12 11 (10) . 9 8 .7 4 3 2 1 Gravel, cobble, and Gravel, cobble, and houlder Gravel, cobble, and boulder Gravel, cobble, and boulder particles are 50-75% surrounded by fine boulder particles are 0-25% surrounded by fine particles are 25-50% surrounded by fine sediment, Embeddedness particles are more than 75% surrounded by fine sediment sediment. Layering of comble provides diversity scdiment. of niche space. SCORE 19 17 14 13 12 11 (10) 4 3 2 1 18 15 9 8 . 7 6 Only 2 of the 4 habitat Only 3 of the 4 regimes Dominated by 1 velocity/ All four velocity/denth All four versions y deput regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 Velocity/Depth present (if fast-shallow is regimes present (if fast-shallow or slow-shallow depth regime (usually slow-Regime missing, score lower than if deep). missing other regimes). are missing, score low). m.) 5 4 3 2 1 0 SCORE 20 19 18 17 16 15 [4 13 12 11 10 8 7 6

| the bittorn affected by sediment deposition. \$\frac{5.309(\chick{R}(20.509\chick{R})}{20.00000000000000000000000000000000000 | | 16 | | | |
|--|---|---|---|--|--|
| Score Score Commence of riffles and determined shows to brank shows the service of states branks; and minimal stream with normal pattern. Score Commence of riffles stream shows where riffles are continuous, placement of boulders or other large, natural stream where riffles are continuous, placement of boulders or other large, natural stream where riffles are continuous, placement of boulders or other large, natural stream where riffles are continuous, placement of boulders or other large, natural stream where riffles are continuous, placement of boulders or other large, natural stream where riffles are continuous, placement of boulders or other large, natural stream where riffles are continuous, placement of boulders or other large, natural stream states of protection score each small stream stream where riffles are continuous, placement of boulders or other large, natural stream states of the origin stade by Sacratic stream states and stream stream states and stream stream states and stream stream states and stream stream states and stream states and stream stream stream states and stream stream stream stream stream st | Sediment | islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by | formation, mostly from gravel, sand or fine sediment: 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in | new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of | material, increased bar development; more than 50% (80% for low-gradien of the bottom changing frequently; pools almost absent due to substantial |
| Channel Channel substrate is exposed. 20 9 18 17 16 | SCORE | 20 19 18 17 16 | 15 14 13 12 11 | (10) 9 8 7 6 | 5 4 3 2 1 0 |
| Channel Channe | Channel Flow | lower banks, and minimal amount of channel | available channel; or <25% of channel substrate is | available channel, and/or riffle substrates are mostly | |
| Channel Alteration with normal pattern. Alteration with normal pattern. with normal pattern. Alteration with normal pattern. Alteration with normal pattern. Alteration with normal pattern. Alteration of past channelization, i.e., 20 yr) may be present, but recent channelization is not present. Alteration of the pattern of | SCORE | 20, 19, 18, 17, 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 (1) 0 |
| Occurrence of riffles Frequency of Riffles (or bends) Frequency o | Channel | absent or minimal; stream | present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not | extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach | stream reach channelized and disrupted. Instream habitat greatly altered or |
| Frequency of Rillies (or bends) Rillies (or distance between (rillies divided by width of the stream is between 7 to 15 to 25. Rillies (or continue) R | SCORE | 20 19 18 17 16 | 15, 14 13 12 11 | 10 (9) 8 7 6 | 5 4 3 2 1 0 |
| 8.Bank Stability (score cach bank) Note: determine fet or right side growtheram. < 59% of bank affected. Solvious bank affected. Solvious bank affected for fature problems. < 59% of bank affected. Solvious bank affected along straight sections and bends; obvious bank sloughing; 60-100% of bank areas of erosion; high erosion potential during floods. SCORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Note that Bank 10 9 8 7 6 5 4 3 2 1 0 Note than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation including trees, understory shrubs, or nonvoody macrophytes: vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed to grow naturally. CCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Right Bank 10 9 8 7 6 5 4 3 2 1 0 | 7. Frequency of Riffles (or bends) | relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural | infrequent; distance between riffles divided by the width of the stream is between 7 to | bottom contours provide some habitat; distance between riffles divided by the width of the stream is | shallow riffles; poor habitat; distance between riffles divided by the width of the |
| Stability (core cach bank) Stability (score cach bank) Note: determine befor right side py facing downstream. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Nogetative Protection of more than 90% of the streambank streames acovered by native vegetation, including intended in mediate riparian zone covered by mative vegetation, including intended to right almost all plants allowed to grow naturally. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Nogetative Protection of more well-protection of more well-protection of through grazing or moving minimal or not evident; almost all plants allowed to grow naturally. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Nogetative Protection in meluding trees, understory shrubs, or nonwoody macrophytes: vegetation in frough grazing or moving minimal or not evident; almost all plants allowed to grow naturally. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone > 18 meters; human activities have impacted zone. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone > 18 meters; human activities have impacted zone. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone > 18 meters; human activities have impacted zone only minimally. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone > 18 meters; human activities have impacted zone only minimally. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone > 18 meters; human activities have impacted zone only minimally. SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 | SCORE | | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| Left Bank 10 9 8 7 6 5 4 3 2 1 0 | 8.Bank Stability (score each bank) Note: determine left or right side by facing downstream. | erosion or bank failure absent or minimal; little potential for future problems. <5% of bank | infrequent, small areas of crosion mostly healed over. 5-30% of bank in reach has | 60% of bank in reach has areas of crosion; high erosion potential during | areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has crosional scars. |
| Right Bank 10 9 8 7 6 5 4 3 2 1 0 Negetative Protection Score each Score each Score each Score each Streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes: vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. CCORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Roy of the streambank surfaces covered by native vegetation, including trees, or nonwoody macrophytes: vegetation, but one class of plants is not well-represented: disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. CCORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone > 18 meters; human activities (i.e., parking lots, lawrs, or crops) have not impacted zone. CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone < 6 12 meters; human activities have impacted zone a great deal. CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Roy of the streambank surfaces covered by vegetation; disruption obvious; patches of bare surfaces covered by native vegetation; disruption obvious; patches of bare surfaces covered by vegetation; disruption obvious; patches of bare surfaces covered by vegetation; disruption obvious; patches of bare surfaces covered by vegetation; disruption obvious; patches of bare surfaces covered by vegetation; disruption obvious; patches of bare surfaces covered by vegetation; disruption obvious; patches of bare surfaces covered by vegetation; disruption of obvious; patches of bare surfaces covered by vegetation; disruption of obvious; patches of bare surfaces covered by vegetation; disruption of obvious; patches of bare surfaces covered by vegetation connent less than one-half of the potential plant stubble height remaining. SCORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone 6 12 meters; human activities have impacted zone a great deal. CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 | SCORE | | 8 7 6 | 5 4 3 | 2 I 0 |
| streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes: vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. CCORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Right Bank 10 9 8 7 6 5 12 meters; human activities (i.e., parking lots, coacheach ank riparian one) CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone <6 meters; human activities (i.e., parking lots, coacheach ank riparian one) CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone <6 meters; human activities (i.e., parking lots, coacheach ank riparian one) CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone <6 meters; human activities have impacted zone only minimally. CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone <6 meters; human activities have impacted zone only minimally. CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone <6 meters; human activities have impacted zone only minimally. CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone <6 meters; human activities have impacted zone only minimally. CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Right Bank 10 9 8 7 6 5 4 3 2 1 0 CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 | SCORE (RB) | Right Bank 10 9 | 8 7 6 | 5 (4) 3 | |
| CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Night Bank 10 9 8 7 6 5 4 3 2 1 0 Night Bank 10 9 8 7 6 5 4 3 2 1 0 Night Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 Right Bank 10 9 8 7 6 5 4 3 2 1 0 Nidth of riparian zone < 6 meters; human activities have impacted zone only minimally. Some agreat deal. | 9. Vegetative Protection (score each bank) | streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes: vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to | surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant | surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble | streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. |
| O. Riparian (egetative (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Width of riparian zone >18 meters; human activities human activities human activities have impacted zone only minimally. Width of riparian zone 6 meters; little or no riparian zone activities have impacted zone a great deal. Width of riparian zone 6 meters; little or no riparian zone activities no ear great deal. Width of riparian zone 6 meters; little or no riparian zone activities have impacted zone a great deal. Width of riparian zone 6 meters; little or no riparian zone activities no ear great deal. | CORE LB) | Left Bank 10 9 | | (5) 4 3 | 2 |
| O. Riparian / Gegetative context of the score each ank riparian one) CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 Right Bank 10 9 8 7 6 5 4 3 2 1 0 Right Bank 10 9 8 7 6 5 4 3 2 1 0 | SCORE RB) | | 8 7 6 | 5 4 3 | 2 1 0 |
| CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 CORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 | 0. Riparian Vegetative Lone Width | meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns or crops) have not | meters: human activities have impacted zone only | 12 meters; human activities have impacted | meters: little or no riparian vegetation due to human |
| CORE Right Bank 10 9 8 7 6 5 4 3 (2) 1 0 | score each eank riparian one) | impacted zone. | | | |
| | eank riparian one) CORE | Left Bank 10 9 | 8 7 6 | 5 43 | (2) 1 0 |

(RB)
Total Score

NOTES/COMMENTS:

High Gradient Stream Data Sheet STREAM NAME: SUGAT LOCATION: STATION#: MILE: BASIN/WATERSHED: LAT.: LONG.: USGS 7.5 TOPO: DATE: 14 DR OSTIME: 3.45 DAM INVESTIGATORS. TYPE SAMPLE: 0 P-CHEM 0 Macroinvertebrate 0 FISH 0 BACT. Past 24 hours WEATHER: Now Has there been a heavy rain in the last 7 days? A 0 Heavy rain 0 Yes KNO Air Temperature Θ O Steady rain "C. Inches rainfall in past 24 hours_ A Intermittent showers % Cloud Cover A θ Clear/sunny 3.6 Cond. 270 P-Chem: Temp(°C)_ D.O. (mg/l)_ %Saturation pH(\$,U.)_ 9 Grab INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: rooks FEATURES: Predominant Surrounding Land Use: Stream Width ſŧ 0 Surface Mining Forest Range of Depth fi 9 Construction O Deep Mining Average Velocity fi/s θ Pasture/Grazing 9 Commercial Oil Wells Discharge cfs 0 Industrial 9 Silviculture Est, Reach Length 0 Land Disposal 9 Row Crops 0 Urban Runoff/Storm Sewers Stream Flow: Hydraulic Structures: Stream Type: 0 Dry 9 Pooled KLow 0 Normal A Perennial A Intermittent θ Dams Θ Bridge Abutments 0 High 9 Island 9 Waterfalls 0 Very Rapid or Torrential θ Ephemeral θ Seep 9 Other Riparian Vegetation: Dom. Tree/Shrub Taxa Canopy Cover. Channel Alterations: Dominate Type: θ Fully Exposed (0-25%) 0 Dredging XTrees XShrubs θ Grasses X Herbaceous 0 Partially Exposed (25-50%) M Channelization Partially Shaded (50-75%) (OFull OPartial) Number of straia 0 Fully Shaded (75-100%) Riffle % Run % Substrate 0Est. 0P.C. % Pool Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock Habitat Condition Category Parameter Optimal Suboptimal Marginal Poor Greater than 70% of 40-70% mix of stable Less than 20% stable habitat: 20-40% mix of stable substrate Javorable for habitat; well-suited for full habitat; habitat availability lack of habitat is obvious; Epifaunal epifaunal colonization and fish cover; mix of snags, submerged logs, undercut colonization potential; adequate habitat for less than desirable; substrate unstable or lacking. Substrate/ substrate frequently Available maintenance of populations; disturbed or removed. Cover banks, cobble or other stable habitat and at stage presence of additional substrate in the form of newfall, but not yet prepared to allow full colonization potential (i.e., logs/snags that are not new fall and for colonization (may rate at high end of scale). not transient). SCORE 20 19 18 15 14 $(\widehat{13})$ 12 11 17 16 10 9 8 7 б 4 3 2 .] Gravel, cobble, and boulder particles are 25-50% Gravel, cobble, and boulder particles are 50-75% surrounded by fine Gravel, cobble, and Gravel, cobble, and boulder particles are more than 75% Embeddedness boulder particles are 0-25% surrounded by fine surrounded by fine sediment. surrounded by fine sediment. sediment. Layering of cobble provides diversity sediment. of niche space. SCORE 20 19 18 17 16 15 14 13 12 11 (ii) 7 4 3 2 1 0 8 6 All four velocity/depth Only 3 of the 4 regimes Only 2 of the 4 habitat Dominated by 1 velocity/ Velocity/Depth regimes present (slowpresent (if fast-shallow is regimes present (if fastdepth regime (usually slowmissing, score lower than if missing other regimes). deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 shallow or slow-shallow are missing, score low). Regime

SCORE

20

19 18 17 16

15 14

13 12 11

(10) 9. 8 7 6

5 4 3 2 1

| | oug | 10 |)7 | | | | | | | | | | | , | | | | | |
|---|--|--|---|---|---|--|---|-------------------------------|---|--|---|--|-----------------------------|--|---|--|---|---|-----------|
| 4. Sediment Deposition | Little or mislands or less than 5 low-gradia the bottom sediment of | point 1 % (<2 int suc 1 affec | bars and 20% for cams) of ecd by | forma grave sedim 5-30% gradio | 6 (20-: int) of ed: sli | nostl For fi 50% i The b | y from ne for lo notton | ที | new g sedim bars; low-g bottor depos consti | gravel ient of 30-50 gradie gradie gradie drade drade drade drade | l, san in old 0% (5 nt) o ected obsti ns, ar lepos | ; sedime ructions id bends ition of | e w for ent ent | Heaver mater devel 50% of the freque absenseding | rial, opn (80% bot ently it du | incre sent, 6 for tom s y, pos e to s | ased more low- chang ols all absta | bar thar grad grad grag mos untia | ient t |
| SCORE | 20 19 | 18 | 17 16 | 15 | 14 | 13 | 12 | 11 | (10) | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | I | 0 |
| 5. Channel Flow Status | Water read lower bank amount of substrate is | cs, and chann | l minimal el | | nnel s | annel | ; or < | 25% | availa | ble cl subst | hanne | 5% of the large of | or [| Very and m standi | iosti | y pre | sent a | chan 15 | nei |
| SCORE | 20 19 | 18 | 17 16 | 15 | 14 | 13 | 12 | 11 | 10. | <u>(9)</u> | 8 | . 7 - | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 6. Channel Alteration | Channeliza absent or n with norma | niníma | ıl; stream | Some present bridge of pas dredgi 20 yr.) recent present | t, usua abutn t chana ng, (gi may l chann | ally in nents neliza reater be pro | area ; evid ition, than esent. | lence i.c., past but | shorin on bot 80% o | ive; e g stri h bar f stre | emba icture iks; a am re | may be nkments s preser and 40 to each disrupte | nt | Banks cemer stream and di habita remov | it; o i rea isrup i gre | ver 8 ch ch ted. atly: | 0% o lanne Instre altere | Tthe lized am | : d |
| SCORE | 20 19 | 18 | 17 16 | 1.5 | 14 | 13 | 12 | 11 | 10 (| \mathfrak{I} | 8 | . 7 | 6 | 5 | 4 | 3 | 2 . | 1 | 0 |
| 7. Frequency of Riffles (or bends) | Occurrence relatively fi distance be divided by stream <7:1 7); variety of kcy. In stre riffles are o placement o other large, obstruction | requent ween width (gene of hab ams v ontinu nature | nt; ratio of riffles of the erally 5 to itat is where lous, lders or al | riffles of the | ient; d dîvide | istand d by | ce bu the w | ridth | bottom some h between | i contrabita nabita n rifi ith ol | tours it; dis fles d The s | ivided b stream is | יעי | Genera shallov distand divideo stream | w fil ic ho d by | Nes; tivec the v | poor n riff vidth | habi les of ti | itat; |
| SCORE | 20 (19) | 18 | 17 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | . 3 | 2 i | . (| 0 |
| 8.Bank Stability (score each bank) Note: determine left or right side by facing downstream. | Banks stablerosion or beatsent or mediated for mediated for problems. | ank fo inimal r fotur | nilure I: little e | Moders infrequerosion 5-30% areas o | ent sr mostl of ban | nall a ly hea ık in a | reas iled o | ver. | Moders 60% of areas o crosion floods. | f bank f eros | c in re ion; | | ; 2 2 1 5 | Unstab areas; ' along s bends; sloughi as ero | raw traig obvi ng: | " are: tht se tous l 60-10 | as fre ction pank 10% (| s and | ď |
| SCORE (LB) | Left Bank | 10 | 9 | 8 | 7 | | 6 | | 5 | 7 | 4) | 3 | | 2 | | 1 | 0 | | |
| SCORE (RB) | Right Bank | 10 | 9 | 8 | 7 | | 6 | | 5 | (| 1 | 3 | | 2 | | 1 | 0 | | |
| P. Vegetative Protection score each sank) | More than 9 streambank immediate ri covered by rivegetation, i understory si monwoody rivegetative di through graz minimal or ni almost all plagrow natural | surfac ipariar native ncludi hrubs, nacrop isrupti ing or not evi ants al | es and n zone ing trees, or hytes; on mowing dent; | 70-90% surfaces vegetating plants is represer evident plant grareat exhalf of the stubble | s cover on, bus not w ited; d but no owth p tent; n he pot | red by it one vell- lisrup it affe notent ential | y nati class tion cting tial to than c | full any one- | 50-70% surfaces vegetatiobvious soil or covegetation on coverential height results. | s cover ion; d : pate losel on co e-hall il plar | ered to isrup thes d y ero omme of the | tion of bare pped on; less ie | st st ve be | ess that treamby vege treamb ery hig ecn rer centin verage | ank tatio ank h; v nove | surfa n; di vege egeta ed to s or l | ces c srupti tation tion i | on c is ias | ed of |
| CORE LB) | Left Bank | 01 | 9 | 8 | 7 | | 6 | | (5) | 4 | | 3 | | ź | | ì | 0 | | |
| CORE RB) | Right Bank | 10 | 9 | 8 | 7 | | 6 | | (5) | 4 | | 3 | | 2 | | I | 0 | | |
| 0. Riparian | Width of ripa meters; huma (i.e., parking roadbeds, ele lawns, or ero impacted zon | an acti lots. ar-cut ps) ha | ivities 5, | Width o meters; have imp minimal | uman pacted | activ | ities. | | Width o 12 meter activities zone a g | rs; hu s have | man e imp | | me Ve | idth of eters: I egetation divities | ittle m di | or no | ripa | rian | |
| CORE LB) | Left Bank | 10 | 9 | 8 | 7 | | 6 | | 5 | 4 | | 3 | | (2) |) | | û | | |
| | Right Bank | 10 | 9 | 8 | 7 | | 6 | | 5 | 4 | | 3 | | (2) | I | | 0 | | |
| | NOTE | | | | | | | | | | | | | | | | | | _ |

Total Score

NOTES/COMMENTS:

High Gradient Stream Data Sheet STREAM NAME: Unramed) Interfel LOCATION: BASIN/WATERSHED: North Fok STATION# MILE USGS 7.5 TOPO: BIGCKEY LAT. LONG: Dec 05 TIME: 3:45 DAM Beverly DATE INVESTIGATORS: TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT WEATHER: Now Past 24 hours Has there been a heavy rain in the last 7 days? X Yes X Yes 0 No 37 °C. Inches rainfall in past 24 hours O B Heavy rain 0 0 Steady rain a Intermittent showers % Cloud Cover θ Clear/sunny P-Chem: Temp(°C) 2.0 Cond. 411) D.O. (mg/l)_ pH(S.U.) %Saturation_ θ Grab INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: Stream Width fì Range of Depth CSurface Mining O Construction ft Average Velocity 0 Deep Mining ft/s 0 Commercial 9 Pasture/Grazing Discharge cfs 8 Oil Wells 8 Industrial 0 Silviculture Est. Reach Length 0 Land Disposal 0 Urban Runoff/Storm Sewers θ Row Crops Stream Flow: Stream Type: Hydraulic Structures: **A**Dry 0 Pooled 0 Low 9 Normal 9 Perennial 9 Intermittent 0 Dams 0 Bridge Abutments 0 High 0 Very Rapid or Torrential Ephemeral O Seep θ Island θ Waterfalls θ Other halase Fill Riparian Vegetation: Dom. Tree/Shrub Taxa Canopy Cover: Channel Alterations: Dominate Type 0 Fully Exposed (0-25%) M Dredging Channelization 17 Trees 0 Shrubs A Partially Exposed (25-50%) 9 Grasses 9 Herbacenus θ l'artially Shaded (50-75%) (OFull OPartial) Number of strata 8 Fully Shaded (75-100%) Riffle % Substrate 0Est, 0P.C Run % Pool Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) .Oy y Bedrock Habitat Condition Category Parameter Optimal Suboptimal Marginal Poor Greater than 70% of 40-70% mix of stable Less than 20% stable habitat: 20-40% mix of stable habitat; well-suited for full colonization potential; habitat; habitat availability less than desirable; substrate favorable for lack of habitat is obvious; substrate unstable or lacking Epifaunal enifaunal colonization and Sübstrate/ fish cover; mix of snags, submerged logs, undercut banks, cobble or other adequate habitat for substrate frequently Available Cover maintenance of populations; presence of additional disturbed or removed. stable habitat and at stage substrate in the form of to allow full colonization potential (i.c., logs/snags that are not new fall and newfall, but not yet prepared for colonization (may rate at high end of scale). not transient). SCORE 20 19 13 17 16 15 14 13 12 10 9 3 7 6 5 (4) 3 2 Gravel, cobble, and Gravel, cobble, and boulder particles are 25-50% Gravel, cobble, and Gravel, cobble, and boulder boulder particles are 0-25% surrounded by fine particles are more than 75% surrounded by fine sediment. Embeddedness boulder particles are 50surrounded by fine sediment 75% surrounded by fine sediment. Layering of cobble provides diversity sediment. of niche space SCORE 20 19 17 14 13 12 11 10 9 7 4 3 2 1 18 16 15 **(**6) Dominated by 1 velocity/ depth regime (usually slow-Only 3 of the 4 regimes present (if fast-shallow is All four velocity/depth Only 2 of the 4 habitat Velocity/Depth regimes present (slow-deep, slow-shallow, fastregimes present (if fast-shallow or slow-shallow Regime missing, score lower than if deep). deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 missing other regimes). are missing, score low).

SCORE

19 18 17 16

15 14

13 12 11

10 9 8 7 6

5)

3 2 1

| <u> HF-</u> | 15 | | ··· | | | | | | | | | | | | | | | | |
|--|--|--|---|----------|--|---|--|---|------------------------------|--|---|---|--|--|---|--|---|--|-----------|
| 4. Sediment Deposition | Little or islands of less than low-grad the botto sediment | r point 5% (<2 lient stre m affec | bars and 20% for earns) of ted by | ď | Some forma gravel sedim 5-30% gradie affecte pools. | tion, i . sanc ent; 6 (20- nt) of | most! I or fi 50% : The b | y from ine for for ottor | n w- 1 | new g sedim bars; low-gi botton deposi constr moder | radient) | and o old ar (50-l of th ed; so struc and l ositio | or fine and new 80% for its formal to the state of the st | mate deve 50% of the frequence | vy de rial, dopn (80%) e bouentl nt du ment | incre nent; % for ttom y, po- ie to s | ased more low- chan ols al subst | bar than gradi ging most antial | ieni I |
| SCORE | 20 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | П | 10 | | 8 | 7 (6 |) 5 | 4 | 3 | 2 | 1 | 0 |
| 5. Channel Flow Status | Water reallower bar amount of substrate | nks, and If chann | l minim el | ial | Water availat of char expose | ole ch nnel s | annel | ; or < | | availal | | nnel. | | and | | y pre | scnt | | nel |
| SCORE | 20 19 | 18 | 17 | 16 | 15 | 14 | .13 | 12 | 11 | . 10 | 9 | 8 | 7 6 | 5 | 4 | . 3 (| 2 | 1 | () |
| 6. Channel Alteration | Channeli: absent or with norm | minima | ıl; strea | m | Some of present of past dredgir 20 yr.) recent of present of present of present of the present o | t, usua abutn chana ng. (ga may l chana | ally in nents neliza reater be pre | n area ; evidention; than esent, | ence i.e., past but | shoring on both 80% of | z structi i banks f stream | banki ures p , and i reac | nents or resent 40 to | Bank ceme streat and c habit remo | int; o m rea lisrup at gre | ver 8 ich cl ited. atly | 0% o namne Instr altere | f the lized eam | í |
| SCORE | 20 19 | 1.8 | 17 1 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 8 | . 1 | 7 6 | (5) | 4 | 3 | 2 | 1 (| 0 |
| 7. Frequency of Riffles (or bends) | Occurrent relatively distance b divided by stream <7 7); variety key. In st riffles are placement other large obstructio | frequent to the frequent of th | it; ratio riffles of the erally 5 itat is where lous, lders or | of | Occurred infrequency filles of the solution of | ent; d Iivide | istano d by | ce bet | idth | Occasion bottom some hetween the wide between | contou ahitat: o n riffics th of th | rs pro distant divid e stre | vide ce ded by | Gene shalld distar divide stream | ow rid ace be ad by | fles: twee the v | poor n rifi vidth | habit Nes of th | tal; |
| SCORE | | 18 | | 6 | 15 | J4 . | 13 | 12 | 11- | 10 | 9 8 | 7 | 6 | 5 | . 4 | 3 | 2 | 1 . 0 |) |
| B.Bank Stability (score each bank) Note: determine eft or right side ny facing lownstream. | Banks staterosion or absent or r potential f problems. affected. | hank fa ninimal or futur | ilure ; little e | 6 | Andera nfreque rosion -30% o reas of | ent, sr mostl of ban | nall a ly hea ık in ı | reas o | ver. (| Modera 60% of areas of erosion floods. | bank ir crosio | reac n; híg | h has h | Unsta areas; along bends slough has cre | "raw straig obvi ing; | " are tht se tous t 60-10 | as fre ection pank 00% | quen s and | i |
| CORE LB) | Left Bank | 10 | 9 | | 8 | 7 | , | 6 | | 5 | 4 | (| 3) | 2 | | ī | 0 | 1 | |
| SCORE RB) | Right Bank | k 10 | 9 | 1 | 8 | 7 | ' | 6 | | 5 | 4 | (| | 2 | | 1 | 0 | 1 | _ |
| l. Vegetative Protection score each ank) | More than streambanh immediate covered by vegetation, understory nonwoody vegetative through gra minimal or almost all p | k surfac ripariar r native i includi shrubs, macrop disrupti azing or not evi plants al | es and i zone ing tree: or hytes; on mowin dent; | s, re pi | 0-90% urfaces egetation lants is epresen vident l lant gro reat ext alf of th ubble h | cover on, but not we ted; de but no owth p lent; no re pot | red by it one vell- lisrup it affe notent nore t lential | y native class tion cting to the class to the change than e | full any ne- | 50-70% surfaces vegetation obvious: soil or el vegetation than one potential height re | covere on: disr patche losely com chalf of plant s | d by aptions of the stubble | n pare ed less | Less the stream by veg stream very his been re 5 cention average | bank etatio bank gh; v move meter | surfa on; di vege egeta ed to | ices of srupt tation ition | ion o 1 is has 1 | |
| CORE LB) | Left Bank | | 9 | | 8 | 7 | | 6 | | 5 | 4 | _ (3 | | . 2 | | 1 | 0 | | |
| CORE RB) | Right Bank | 10 | 9 | | 8 | 7 | | 6 | | 5 | 4 | G | | 2 | | ı | 0 | | |
| 0. Riparian egetative one Width core each ank riparian one) | Width of ri meters; hun (i.e., parkin roadbeds, c lawns, or cr impacted zo | nan acti g lots, lear-cut ops) ha | vities s, | m ha | idth of eters: h ive imp inimal | uman acted | ı activ | rities | ; | Width of 12 meter activities zone a gr | s; huma have ir | in npact | ed | Width (meters: vegetat activitie | little ion d | or no | o ripa | rian | |
| | Left Bank | | | 1 | 8 | 7 | | 6 | Ì | 5 | 4 | , | | (²) | | | .0 | | ĺ |
| CORE JB) | Sert Dank | W | 9 | 1 | O | ′ | | v | | 5 | ÷ | 3 | ŀ | | | ı | .0 | | . 1 |

Total Score

NOTES/COMMENTS:

| *************************************** | TV | | F | ligh (| Grac | dien | ıt St | rean | ı Dat | a Sł | ieet | | | | | | | | |
|---|--|---|------------------------------------|---|--|--|--|--|---------------------------------------|------------------|--------------------------|-------------------------|-------------|------------------------|---------------------|--------------|--------------|---------------------------|----------|
| STREAM NA | ME: Unnam | ed to | b | to 1 |)6£ | चील | (g. | LOC | OITA | i: F | gn | q | d | 0 | | | Te | X '51 | 'nρ |
| STATION#: | | | MILI | E: | | | | BAS | INWA | TERS | SHED |): Ne | 4 | F | σK | | KŸ | <u>_{_k}</u> | ver |
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| Hydraulic Stru θ Dams θ E θ Island θ V θ Other | Bridge Abutmer | nts | | | 0.0 | am F Iry Iigh | Ð P | ooled ry Ra |) Lo | ow Octen | 0 No | ormat | | 0 Per | eam ennia hem | ı J | (Inte | | ent |
| Riparian Veget | | om. Tree/ | Shrub | Taxa | Can | юру (| Cover | : | | | <u>C</u> l | annel | Alte | rations | | | | | _ |
| Dominate Type | | | | | 1 | • | xpose | • | | | 1 | Dredgi ~: | _ | | | | | | |
| A Trees 0 SI 0 Grasses 0 He | | | | | | | | | 25-50% 0-75% | | 1 | Chann Full 0f | | | | | | | |
| | Grasses θ Herbaceous X Partially Shaded (50-75%) (θFull θPartial) Number of strata | | | | | | | | | | | | | | | | | | |
| Substrate 0Est | | I | Riffle | | _% | | | | Run_ | | _% | | I | | Pool | | | _% | |
| Silt/Clay (<0.0 | | (| | | | | | | | | | | | | | | | | |
| Sand (0.06 – 2 | | X | 9 | | | · | | | | | | | | | | | | | |
| Gravel (2-64 n | | | | 0.1 | | | _ | | | | | | <u> </u> | | | | | | |
| Cobble (64 - 2 | | | | 166 | <u>)()</u> | <u>15</u> | _ | | | | | | | | | _ | | | |
| Boulders (>25 | 6 mm) | | | | | $ \perp $ | | | 士 | | | | _ | | | | | | |
| Bedrock | | | | | | | <u> </u> | 41 | 11 | | | | | | | | | | |
| Habitat | | | | | | | | ditio | n Cate | gor | <u>y</u> | | | | | | | | |
| Parameter | Opti | mal | | | Subo | ptim: | กใ | | | Ma | rgina | 15 | | | | Po | 0r | | |
| I. Epifaunal Substrate/ Available Cover | Greater than substrate fave epifaunal cole fish cover; m submerged lo banks, cobble stable habitat to allow full c potential (i.e., that are not renot transient). | orable for enization ix of snag gs. under or other and at sta colonization logs/snag | and S, cut ge on zs | 40-709 habitat coloniz adequa mainte present substra newfal for colo high er | well zation te hal nance of a le in le | -suite potes hitst f of po- additi the fo- not y- tion (t | ed for ntial; for opulat ional om of et prej may ra | ioлs; | | ian de ate fr | itat a sirab equen | vailah le; itly | ility | lack | oſha | ıbita | ıt is c | able ha | |
| SCORE | 20 19 1 | 8 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 0 | 0 |
| 2. Embeddedness | Gravel, cobble boulder partic 25% surround sediment. La cobble provid of niche space | les are 0- led by line yering of es diversi | t | Gravel, particle surrour | s arc | 25-5(|)% | | | er pari | icles | nd are 50 by fine | | partic | les a | re m | nore I | d boui than 7 sedir | 75% |
| SCORE | 20 19 1 | | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2.4 | (1) | 0 |
| 3. Velocity/Depth Regime | All four veloc regimes prescr deep, slow-sha deep, fast-shal is < 0.3 m/s, d m.) | nt (slow- dlow, fast low). (So | t- | Only 3 present missing missing | (if la: 5cor | st-shā e low | illow i /cr tha | s in if | Only 2 regume shallor are mi | s pres | ent (i low-s | if fast- hallov | | Domi depth deep) | regir | i by ne (| i ve usua | locity ily slo |))w- |
| | | | | | | | | | | _ | | _ | - 1 | | 4 | ٠, ٠ | - 1 | / · } | ۸ J |

Pond 106

| | POUL | 10 4 | · | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|---|--|--|---|--|---|--|--|---|-------------------------------|
| 4. Sediment Deposition | Little or n islands or less than t low-gradi the botton sediment of | point 5% (<) ent str a affec | bars and 20% for eams) of ited by | forma grave sedim 5-30% gradie | % (20- ent) al ed; sl | mostl d or f -50% f the t | ly fro inc for lo | TT) | new sedin bars: low- botto depo cons mode | grave ment : 30-5 gradi om af osits a trictic erate | el, sar on ol 60% (ent) (fected it obsi | sition of or d and 50-80 of the f; sed truction d be sition | fine new 1% for iment ons, nds: | mate deve 50% of th frequabse | rial, lopn (80% e boi senti nt du | incre ent; i % for tom o y; poo e to s | s of fine ased ba more th low-gra changin ols almo ubstant sition. | r an idient g isl |
| SCORE | 20 19 | 18 | 17 16 | 15 | 14 | 13 | 12 | U | 10 | 9 | 8 | | 6 | 5 | 4 | 3 | 2 (1 | 0 |
| 5. Channel Flow Status | Water read lower bank amount of substrate it | ks, and chann | l minimal el | | ible ch innel s | anne | ; or < | <25% | avail | able o | chann | 15% o el. an are n | d/or | and r | nosti | y pre: | er in cha | annel |
| SCORE | 20 19 | 18 | 17 16 | 15 | . 14 | 13 | 12 | . 11 . | (10) | 9 | 8 | 17: | 6 | 5 | :: 4 | 3 | 2 1 | 0 |
| 6. Channel Alteration | Channelize absent or n with nonne | ninima | ıl; stream | Some present bridge of pas dredgi 20 yr.) recent present | it, usu abuti t chan ing. (g) may chanc | nally in ments incliza greater he pr | n area i; evic ation, r than esent | ience i.c., past but | | sive; ng str ith ba of str | emba ructur inks; a eam r | and 40 each | nts o sent) to | r ceme strear and d | nt; o n rea isrup at gro | ver 8(ch ch ted. atly a | vith gab 0% of the anneliz Instrear altered of |)c cd ព |
| SCORE | 20 19 | ıs | 17 16 | |]4 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 (1) | 0 |
| 7. Frequency of Riffles (or bends) | Occurrence relatively find distance be divided by stream <7: 7); variety key. In streiffles are optocement other large, obstruction | requer width I (general of hab cams vecontinuor of bour | it; ratio of riffles of the erally 5 to ital is where lous, lders or all | riffics | sent: d divide | distan ed by | ce be the w | ridth | some | n cor habit en rii idth c | ntours at; di ffles o of the | prov stance livide strear | ide : d by | shallo distan divide | w rif ce be d by | Nes; ; twee the v | nt water poor ha n riffles vidth of of >25. | bitat; thc |
| SCORE | | | 17 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | . 7 | 6 | 5 | 4 | 3 | 2 (1) | 0 |
| Bank Stability (score each bank) Note: determine eft or right side oy facing | Banks stabl crosion or be absent or me potential for problems, affected. | oank fa iinima r futur | silure I; little re | Moders infrequences erosion 5-30% areas o | ent, si i most of bai | mall a Ily hea nk in | areas aled c | ver. | Model 60% of arcas of crosio floods | of ban of erc n pot | k in i ision: | each high | has | areas; along : bends; | "raw straig obvi ing; | " area tht scious b 60-10 | 10% of | nd |
| SCORE LB) | Left Bank | 10 | 9 | 8 | | 7 | 6 | | 5 | (| 4 | 3 | | 2 | | 1 | 0 | |
| SCORE RB) | Right Bank | 10 | 9 | 8 | 7 | 7 | 6 | | 5 | (| 3 | . 3 | | 2 | | 1 | 0 | |
|). Vegetative Protection score each (ank) | More than Streambank immediate reversed by vegetation, understory someone with the streambal of through grammal or almost all place and the streambal or all places are streambal or all places and the streambal or all places are strea | surfactinative includ includ includ includ includ including or including or including ants a | es and n zone ing trees, , or ohytes, ion r mowing ident; | 70-90% surface vegetati plants is represed evident plant gratex inalf of stubble | s coverion, but not to the coverion of the cov | ered but one well- disrugot affor poten more tentia | y nate classification tion to the classification to the classification of the classifica | ive s of g full o any one- nt | 50-70% surface vegeta obviou soil or vegetai than or potenti height | es contion; is: par close tion c ic-hai al pla | vered disrustehes dy crossomm for the street | by ption of bar opped on; le he ubble | re | | bank etatio bank gh: v move moter | surfa on; dis vegeta egeta ed to s or l | ces coveruption is tion has ess in | oľ |
| CORE LB) | Left Bank | 10 | 9 | 8 | 7 | | 6 | | 5 | | 4 | 3 | | 2 | | t | 0 | |
| CORE RB) | Right Bank | [0] | 9 | 8 | 7 | | 6 | | 5 | | 4 | 3 | | 2 | | l | 0 | |
| 0. Riparian Vegetative one Width score each ank riparian one) | Width of rip meters: hum (i.e., parking roadbeds, cli lawns, or cro impacted zon | an acti lots, car-cui pps) ha | ivilies Ls. | Width o meters; have in minimal | humai pacted | n acti | villes | . { | Width (12 mete activities zone a | ers: h es ha | uman ve im | pacted | 1 | Width of meters: vegetati activitie | little on di | or no | riparia | |
| CORE JB) | Left Bank | 10 | 9 | 8 | 7 | | 6 | | 5 | (| (P | 3. | | 2 | 1 | ! | ŋ | |
| | Right Bank | 10 | 9 | 8 | 7 | | 6 | | 5 | | 4 | 3 | | 2 | j | | 0 | |
| I Score | NOTE | SICC | MMES | /ZT | | | | | | | | | | | | | | |

Total Score

NOTES/COMMENTS:

High Gradient Stream Data Sheet STREAM NAME: Unamed BASIN/WATERSHED: STATION #: MILE: LAT. 37°12' 57" LONG 82°58 USGS 7.5 TOPO: Blackey DATE: 8 Jan 05 TIME: 3:45 DAM INVESTIGATORS: TYPE SAMPLE: 0 P-CHEM 0 Macroinvertebrate 0 FISH 0 BACT. WEATHER: Now Past 24 hours Has there been a heavy rain in the last 7 days? A 9 Heavy rain XYes @ No 0 0 Steady rain Air Temperature °C. Inches rainfall in past 24 hours θ 0 Intermittent showers % Cloud Cover Clear/sunny Ø P-Chem: Temp(°C) 5.6 368 D.O. (mg/l) pH(S.U.) %Saturation 0 Grab INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: Stream Width fi X Surface Mining Range of Depth ft 9 Construction Average Velocity tivs 0 Deep Mining O Pasture/Grazing 9 Commercial 0 Oil Wells Discharge cis O Industrial 0 Silviculture Est. Reach Length θ Land Disposal 0 Urban Runoff/Storm Sewers 0 Row Crops Stream Flow: Stream Type: Hydraulic Structures: 0 Perennial 0 Intermittent X Dry 0 Pooled 0 Low 6 Normal 9 Dams 9 Bridge Abutments θ Hìgh 9 Very Rapid or Torrential Ephemeral 0 Scep 0 Island 0 Waterfalls 0 Other Canopy Cover: Riparian Vegetation; Dom, Tree/Shrub Taxa Channel Alterations: Dominate Type: 0 Fully Exposed (0-25%) 0 Dredging Trees Shrubs O Grasses Herbaccous θ Partially Exposed (25-50%) Channelization 0 Partially Shaded (50-75%) (OFull OPartial) Number of strata K Fully Shaded (75-100%) Riffle Run Pool % Substrate 0Est. 0P.C. Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobbie (64 - 256 mm) Boulders (>256 mm) Bedrock Habitat **Condition Category** Parameter Suboptimal Optimal Marginal Poor Greater than 70% of 40-70% mix of stable 20-40% mix of stable Less than 20% stable habitat: substrate favorable for habitat; well-suited for full habitat; habitat availability lack of habitar is obvious; Enifaunal epifaunal colonization and fish cover; mix of snags, submerged logs, undercut colonization potential; adequate habitat for less than desirable; substrate unstable or lacking Substrate/ substrate frequently Available Cover maintenance of populations; presence of additional substrate in the form of disturbed or removed, banks, cobble or other stable habitat and at stage newfall, but not yet prepared for colonization (may rate at high end of scale). to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). SCORE 20 19 18 17 16 15 14 13 12 (11) 10 9 8 7 6 4 3 2 1 Gravel, cobble, and Gravel, cobble, and boulder Gravel, cobble, and Gravel, cobble, and boulder boulder particles are 0-Embeddedness boulder particles are 50particles are more than 75% surrounded by fine sediment. 25% surrounded by fine 75% surrounded by fine surrounded by fine sediment. sediment. Layering of cobble provides diversity sediment. of niche space. 13 12 11 SCORE 20 19 17 15 14 10 8 7 4 3 2 1 18 Only 2 of the 4 habitat Dominated by 1 velocity/ All four velocity/depth Only 3 of the 4 regimes Velocity/Depth regimes present (slowpresent (if fast-shallow is egimes present (if fastdepth regime (usually slowmissing, score lower than if missing other regimes). deep slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 shallow or slow-shallow are missing, score low). Regime dcep). 17 (9)7 SCORE 20 19 18 16 15 14 13 12 11 10 8 6 5 4 3 2 1

H-17

| Channel Alteration Channel absent or minimal; stream with normal pattern. Some channelization present, usually in areas of bridge abuttnents; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present. | than gradient gradien |
|--|--|
| Score Water reaches base of both lower banks, and minimal and unosity present and mostly present iffle substrate is exposed. Water fills >75% of the available channel, and/or iffle substrates are mostly exposed. | channel as 1 0 gabien or of the elized ream ed or 1 0 ater or habitat; files of the |
| Channel Status lower banks, and minimal amount of channel substrate is exposed. available channel, and/or of channel substrate is exposed. available channel, and/or iffle substrates are mostly exposed. available channel, and/or iffle sextensive, entensive, entensive, entensive, en | gabion or of the elized ream ed or later or habitat; files o of the |
| Channel Alteration Channel Alteration Channel Channel absent or minimal; stream with normal pattern. Channel Channe | gabion or of the elized ream ed or l 0 |
| Alteration absent or minimal; stream with normal pattern. absent or minimal; stream with normal pattern. | of the elized ream ed or I 0 Her or r habitat; Tles |
| 7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream syling (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or | nter or habitat; Thes |
| Frequency of Riffles (or distance between riffles divided by width of the stream is between 7 to 57); variety of habitat is key. In streams where riffles are continuous, placement of boulders or | r habitat; Tles 1 of the |
| other large, natural obstruction is important. | ·25. |
| | 1 0 |
| 8.Bank Stability (score each bank) Note, determine left or right side by facing downstrean, Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected. Moderately stable; of 60% of bank in reach has areas of erosion, high erosion potential during floods. Moderately unstable; 30-60% of bank in reach has areas of erosion, high erosion potential during floods. Unstable; many erod areas of erosion, high erosion potential during floods. Unstable; many erod of 60% of bank in reach has areas of erosion; high erosion potential during floods. Stability (score each bank) Note, determine left or right side by facing downstrean, | equent as and |
| SCORE Left Bank 10 9 8 7 6 5 4 3 2 1 6 (LB) |) |
| SCORE Right Bank 10 9 8 7 6 5 4 (3) 2 1 0 (RB) |) |
| More than 90% of the streambank surfaces and immediate riparian 20ne covered by native vegetation, including trees, understory strubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing almost all plants allowed to grow naturally. More than 90% of the streambank surfaces covered by native vegetation, but one class of plants on twell-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. Less than 50% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare vegetation common; less than one-half of the potential plant stubble height remaining. | covered tion of n is has |
| SCORE Left Bank 10 9 8 7 6 3 4 3 2 1 0 | |
| SCORE Right Bank 10 9 8 7 6 5 4 3 2 1 0 | 1 |
| O. Riparian / Cegetative cone Width of riparian zone > 18 meters; human activities have impacted zone only minimally. Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | arian |
| CORE Left Bank 10 9 8 7 6 5 4 3 2 1 0 | |
| | |

Total Score

NOTES/COMMENTS:



High Gradient Stream Data Sheet STREAM NAME: VIAGONTE Carr (STATION# MILE BASIN/WATERSHED: 59" LONG.: USGS 7.5 TOPO: TIME: Z'OD DAM INVESTIGATORS: TYPE SAMPLE: 9 P-CHEM 9 Macroinvertebrate 9 FISH 9 BACT. WEATHER: Now Past 24 hours Has there been a heavy rain in the last 7 days? 0 Heavy rain 🗶 Yes 0 No °C. Inches rainfall in past 24 hours _____ in. 0 O Steady rain Air Temperature Θ 0 Intermittent showers 5 % Cloud Cover X Clear/sunny P-Chem. Temp(°C) 5.6 D.O. (mg/l) %Saturation pH(S.U.) 0 Grab INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: Stream Width fŧ Surface Mining θ Construction **X** Forest Range of Depth ft ft/s 0 Deep Mining 0 Commercial O Pasture/Grazing Average Velocity 9 Oil Wells Discharge cfs 0 Industrial 0 Silviculture Est. Reach Length 8 Land Disposal 9 Row Crops 0 Urban Runoff/Storm Sewers Stream Type: θ Perennial **X** Intermittent Stream Flow: Hydraulic Structures: **X** Normal 0 Dry 0 Pooled 0 Low X Dams 9 Bridge Abutments 0 High 0 Very Rapid or Torrential @ Ephemeral @ Scep 0 Island θ Waterfalls A Other Channel Alterations: Old Riparian Vegetation: Doin, Tree/Shrub Tasa Canopy Cover: Sediment Dominate Type: 0 Fully Exposed (0-25%) O Channelization Control KTrees X Shrubs 9 Partially Exposed (25-50%) Structure A Grasses A Herbaccous (OFull OPartial) Ahat has tilled in 0 Partially Shaded (50-75%) Number of strata **XFully Shaded (75-100%)** Substrate 0Est. 0P.C. Riffle Run % Pool % Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock Habitat Condition Category Parameter Suboptimal Optimal Marginal Poor 40-70% mix of stable habitat; well-suited for full Greater than 70% of 20-40% mix of stable Less than 20% stable habitat: substrate favorable for habitat: habitat availability lack of habitat is obvious Epifaunal epifaunal colonization and substrate unstable or lacking. colonization potential: less than desirable; Substrate/ fish cover; mix of snags, submerged logs, undercut banks, cobble or other substrate frequently disturbed or removed. adequate habitat for maintenance of populations: presence of additional Available Cover stable habitat and at stage substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). to allow full colonization potential (i.e., logs/snags that are not new fall and not transient). SCORE 20 19 18 17 16 15 14 13 12 11 (iv) 9 3 2 1 8 4 Gravel, cobble, and Gravel, cobble, and Gravel, cobble, and boulder Gravel, cobble, and boulder boulder particles are 50-75% surrounded by fine Embeddedness boulder particles are 0-25% surrounded by fine particles are 25-50% particles are more than 75% surrounded by fine sediment. surrounded by line sediment. sediment. sediment. Layering of cobble provides diversity of niche space. SCORE 19 18 17 15 14 13 12 11 10 8 7 6 5 4 3 2 1 0 All four velocity/depth Only 2 of the 4 habitat Dominated by 1 velocity/ Only 3 of the 4 regimes regimes present (slow-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 depth regime (usually slow-deep). Velocity/Denth present (if fast-shallow is regimes present (if fast-shallow or slow-shallow Regime missing, score lower than if missing other regimes). are missing, score low). SCORE 19 18 17 16 15 14 13 12 11 10 8 6 5 4 3 2 ı

S # 96 9) Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) Little or no enlargement of Some new increase in bar Moderate deposition of Sediment islands or point bars and less than 5% (<20% for new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for formation, mostly from Deposition gravel, sand or fine low-gradient streams) of 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in of the bottom changing frequently; pools almost absent due to substantial the bottom affected by low-gradient) of the sediment deposition. bottom affected; sediment deposits at obstructions, constrictions, and bends; sediment deposition. moderate deposition of pools prevalent. SCORE (ē 4 3 2 20 19 18 17 16 15 14 13 12 11 10 / 8 ı Water reaches base of both lower banks, and minimal Water fills >75% of the Water fills 25-75% of the Very little water in channel Channel Flow available channel; or <25% available channel, and/or and mostly present as riffle substrates are mostly Status amount of channel of channel substrate is standing pools. substrate is exposed. exposed. SCORE 20 19 18 17 15 .14 13 12 11 9 .÷8 .⇒7 .. 5.4 3 2 -1(0)16 10 Channelization or dredging Some channelization Channelization may be Banks shored with gabion or Channel present, usually in areas of absent or minimal; stream extensive; embankments or cement; over 80% of the with normal pattern. Alteration bridge abutments; evidence shoring structures present on both banks; and 40 to stream reach channelized of past channelization, i.e., and disrupted. Instream habitat greatly altered or removed entirely. dredging, (greater than past 80% of stream reach 20 yr.) may be present, but recent channelization is not channelized and disrupted. present. SCORE 2 (1)0 20 19 18 17 16 15 14 13 12 11 9 8 7 4 3 Generally all flat water or shallow riftles; poor habitat; Occurrence of riffles infrequent; distance between Occurrence of riffles Occasional riffle or bend: relatively frequent; ratio of distance between riffles Frequency of bottom contours provide distance between riffles Riffles (or riffles divided by the width some habitat; distance of the stream is between 7 to 15. divided by the width of the stream is a ratio of >25. divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is between riffles divided by the width of the stream is bends) between 15 to 25, key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important SCORE 20 19 18 - 17 (16) 15 14 13 12 11 10 9 8 4 3 2 Unstable, many eroded areas, "raw" areas frequent along straight sections and bends; obvious bank Banks stable; evidence of Moderately stable; Moderately unstable; 30-8.Bank infrequent, small areas of erosion mostly healed over, 5-30% of bank in reach has erosion or bank failure 60% of bank in reach has Stability (score areas of crosion; high erosion potential during absent or minimal, little cach bank) potential for future problems. <5% of bank sloughing; 60-100% of bank has crosional scars. areas of crosion. floods. Note: determine affected. left or right side by facing downstream. SCORE (LB) 10 9 8 7 $\langle 4 \rangle$ 3 2 ţ 0 Left Bank 6 5 SCORE (RB) Right Bank 10 9 8 7 6 5 (4) 3 2 0 Less than 50% of the streambank surfaces covered 9. Vegetative More than 90% of the 70-90% of the streambank 50-70% of the streambank Protection streambank surfaces and surfaces covered by native surfaces covered by vegetation, but one class of immediate riparian zone vegetation; disruption by vegetation; disruption of (score each plants is not well-represented; disruption obvious; patches of bare soil or closely cropped bank) covered by native streambank vegetation is very high; vegetation has been removed to vegetation, including trees, evident but not affecting full understory shrubs, or nonwoody macrophytes, vegetation common, less plant growth potential to any than one-half of the 5 centimeters or less in great extent; more than one-half of the potential plant stubble height remaining. vegetative disruption potential plant stubble average stubble height. through grazing or mowing minimal or not evident; almost all plants allowed to height remaining. grow naturally SCORE Left Bank 10 9 8 7 6 5 4 3 1 0 SCORE (RB) Right Bank 10 8 7 6 5 4 3 2 i 0 Width of riparian zone >18 Width of riparian zone 12-18 Width of riparian zone 6-Width of riparian zonc <0 10. Riparion 12 meters; human activities have impacted meters: little or no riparian meters; human activities meters; human activities vegetative (i.e., parking lots, have impacted zone only vegetation due to human Zone Width roadbeds, clear-cuts, minimally. zone a great deal. activities (score each lawns, or crops) have not impacted zone. bank riparian zone) (3) SCORE (LB) 'n 9 8 7 3 2 Left Bank 10 6 4 1 ر3) SCORE 0 Right Bank 10 9 8 7 6 1 (RB)

Total Score

NOTES/COMMENTS:



Appendix B

Stratum Rank Key



Stratum Rank Key

SR-1

Class Description SR-9 A sole dominant species; no other species exceed SR-2. SR-8 A species so outstanding as to be called the sole dominant; no other species exceeds SR-6. (Given to only one species) SR-7 A species sharing dominance. Given to one, but rarely two species (for example, oak - hickory). SR-6 A species sharing dominance with another, but markedly less important than the main dominant, or a species sharing dominance more or less equally with a number of species. SR-5 Given to the third or forth subdominant where there are two clear dominants, usually given only if all remaining species have low SRs. SR-4 A subordinate species, not a dominant or subdominant, but contributing significantly to both numbers and cover. SR-3 A species with three to several individuals furnishing substantial cover. A species with two to several individuals, but infrequent in number and inconsequential SR-2 in cover.



A species for which only a single individual is observed.

Appendix C

Completed Data Sheets for Longitudinal Profiles, Pebble Counts, and Cross Sections





Longitudinal Profile Data Sheet - Hollow Fill 2

| Project# | 05.02 | Project Name | Carr Creek 404 | | | |
|-----------|------------------|------------------|----------------|------|---------|--|
| Stream/Dr | ainage <u>Ur</u> | named Trib. To C | Carr Creek | Date | 10/8/03 | |
| GPS: N 3 | 37°14′02.4" | | W 82°58'25.0" | | | |
| County K | nott | State KY | Quad Blackey | | | |

| Point | 44 PM 4 9 1 5 74 1 | Elevation | | Water depth | |
|----------|--------------------|-------------|----------------|-------------|----------|
| <u> </u> | from Beg(ft) | | Characteristic | | (Tenths) |
| 1 | 0.0 | 1209.6 | Riffle | Dry | 0.3 |
| 2 | 10.8 | 1210.2 | Pool | Dry | |
| 3 | 13.1 | 1209.7 | Riffle | Dry | |
| 4 | 17.3 | 1211.0 | Pool | Dry | |
| 5 | 36.2 | 1213.1 | Riffle | Dry | , |
| 6 | 40.3 | 1212.4 | Riffle | Dry | |
| 7 | 43.9 | 1214.1 | Pool | Dry | |
| 8 | 57.2 | 1216.6 | Riffle | Dry | |
| 9 | 59.5 | 1216.1 | Riffle | Dry | |
| 10 | 65.7 | 1217.9 | Pool | Dry | |
| 11 | 68.5 | 1217.6 | Riffle | Dry | |
| 12 | 69.8 | 1217.9 | Pool | Dry | |
| 13 | 76.4 | 1218.6 | Riffle | Dry | |
| 14 | 99.7 | 1221.2 | Riffle | Dry | 8.0 |
| 15 | 112.0 | 1223.7 | Riffle | Dry | |
| 16 | 120.8 | 1224.5 | Riffle | Dry | |
| 17 | 138.1 | 1226.6 | Riffle | Dry | |
| 18 | 149.7 | 1228.4 | Riffle | Dry | |
| 19 | 153.1 | 1227.6 | Riffle | Dry | |
| 20 | 157.9 | 1228.2 | Pool | Dry | |
| 21 | 161.5 | 1231.6 | Pool | Drý | 0.8 |
| 22 | 189.5 | 1234.4 | Riffle | Dry | |
| 23 | 192.4 | 1234.1 | Riffle | Dry | |
| 24 | 195.0 | 1234.9 | Pool | Dry | |
| 25 | 216.3 | 1236.7 | Riffle | Dry | |
| 26 | 218.8 | | | Dry | |
| 27 | 222.7 | | Riffle | Dry | |
| 28 | 225.5 | | | Dry | |
| 29 | 229.3 | | | Dry | |
| 30 | 234.3 | | | Dry | |



| Point | Distance | The Property of the Control of the C | | Water depth | Bankfull |
|-------|--------------|--|----------------|-------------|----------|
| | from Beg(ft) | <u> </u> | Characteristic | (Tenths) | (Tenths) |
| 31_ | 235.4 | 1239.6 | Pool | | |
| 32 | 241.2 | 1240.5 | Riffle | Dry | |
| 33 | 261 | 1242.7 | Riffle | Dry | |
| 34 | 265.2 | 1242.4 | Riffle | Dry | |
| 35 | 268.9 | 1243.6 | Pool | Dry | |
| 36 | 298.1 | 1245.6 | Riffle | Dry | |
| 37 | 307.2 | 1246.5 | Riffle | Dry | |
| 38 | 311.5 | 1246.0 | Pool | Dry | 0.9 |
| 39 | 316.1 | 1247.6 | Pool | Dry | |
| 40 | 336.2 | 1279.5 | Riffle | Dry | |
| 41 | 352.5 | 1252.1 | Riffle | Dry | |
| 42 | 354.1 | 1251.6 | Riffle | Dry | |
| 43 | 356.5 | 1252.5 | Pool | Dry | |
| 44 | 371.1 | 1255.2 | Riffle | Dry | |
| 45 | 373.1 | 1254.6 | Riffle | Dry | |
| 46 | 375.5 | 1256.1 | Pool | Dry | |
| 47 | 400 | 1260.4 | Riffle | Dry | |
| 48 | 402.9 | 1259.8 | Riffle | Dry | |
| 49 | 407.2 | 1262.9 | Pool | Dry | |
| 50 | 435.9 | 1266.0 | Riffle | Dry | |
| 51 | 441.9 | 1268.7 | Pool Confluent | Dry | 1.3 |
| 52 | 457.7 | 1270.7 | Riffle | Dry | |
| 53 | 460 | 1270.4 | Riffle | Dry | |
| 54 | 462.9 | 1271.8 | Pool | Dry | |
| 55 | 480.4 | 1275.1 | Riffle | Dry | |
| 56 | 489.5 | 1277.4 | Riffle | Dry | |
| 57 | 491.4 | 1276.8 | Riffle | Dry | |
| 58 | 495.3 | 1278.6 | Pool | Dry | |
| 59 | 508.6 | 1280.1 | Riffle | Dry | |
| 60 | 516.6 | 1281.5 | Riffle | Dry | |



| Point | - 4 - ようには - 40 g - 15 - 47 を459 fg - 161 を 。 | - 「「」、「Artical Control Contr | Stream | Water depth | Bankfull |
|-------|---|--|----------------|-------------|----------|
| | from Beg(ft) | (ft) | Characteristic | (Tenths) | (Tenths) |
| 61 | 530.4 | 1286.5 | Pool | Dry | |
| 62 | 532.7 | 1285.8 | Riffle | Dry | |
| 63 | 535.4 | 1287.3 | Pool | Dry | |
| 64 | 545.1 | 1292.0 | Riffle | Dry | |
| 65 | 560.7 | 1295.5 | Riffle | Dry | |
| 66 | 568.7 | 1297.7 | Riffle | Dry | |
| 67 | 584.9 | 1300 | Riffle | Dry | |
| 68 | 586.2 | 1299.7 | Riffle | Dry | |
| 69 | 591.7 | 1302.2 | Pool | Dry | |
| 70 | 606.5 | 1306.7 | Riffle | Dry | |
| 71 | 610.3 | 1306.5 | Pool Confluent | Dry | 1.1 |
| 72 | 612.1 | 1307.3 | Riffle | Dry | |
| 73 | 622.7 | 1312.1 | Riffle | Dry | |
| 74 | 629.4 | 1316.7 | Riffle | Dry | |
| 75 | 634 | 1318 | Riffle | Dry | 8.0 |
| 76 | 648.6 | 1320.1 | Riffle | Dry | |
| 77 | 655.8 | 1319.6 | Pool | Dry | |
| 78 | 657,9 | 1320.8 | Riffle | Dry | |
| 79 | 671.2 | 1322.7 | Riffle | Dry | |
| 80 | 672.7 | 1324 | Riffle | Dry | |
| 81 | 675.2 | 1324.3 | Riffle | Dry | |
| 82 | 678.9 | 1326.7 | Riffle | Dry | |
| 83 | 688.2 | 1327.9 | Riffle | Dry | |
| 84 | 695.7 | 1331.6 | Riffle | Dry | · |
| 85 | 703.1 | 1332.8 | Riffle | Dry | |
| 86 | 707.1 | 1335.7 | Riffle | Dry | · |
| 87 | 717.5 | 1338.5 | Riffle | Dry | |
| 88 | 724 | 1341.5 | Riffle | Dry | 0.6 |
| 89 | 726.4 | 1343.4 | Riffle | Dry | |
| 90 | 730.7 | 1344.6 | Riffle | Dry | |



| Point | Distance | Elevation | Stream | Water depth | Bankfull |
|-------|--------------|-----------|----------------|-------------|----------|
| | from Beg(ft) | (ft) | Characteristic | (Tenths) | (Tenths) |
| 91 | 735.1 | 1348.1 | Riffle | Dry | |
| 92 | 744.6 | 1350.8 | Riffle | Dry | |
| 93 | 748.8 | 1354.1 | Riffle | Dry | |
| 94 | 752.4 | 1356.5 | Riffle | Dry | |
| 95 | 762 | 1358.6 | Riffle | Dry | |
| 96 | 763.3 | 1359.7 | Riffle | Dry | 0.6 |
| 97 | 766.8 | 1360.9 | Riffle | Dry | |
| 98 | 769 | 1360.6 | Pool | Dry | |
| 99 | 773.1 | 1362.6 | Riffle | Dry | |
| 100 | | | | | |
| 101 | Tributary | | | | |
| 102 | 0.0 | 1266 | Pool | Dry | · |
| 103 | 3.2 | 1268.1 | Riffle | Dry | 0.6 |
| 104 | 14.9 | 1269.4 | Riffle | Dry | |
| 105 | 17.5 | 1268.4 | Pool | Dry | |
| 106 | 21.1 | 1270.8 | Riffle | Dry | |
| 107 | 34.7 | 1273.8 | Riffle | Dry | |
| 108 | 36.3 | 1273.4 | Pool | Dry | |
| 109 | 41.3 | 1275.9 | Riffle | Dry | |
| 110 | 52.3 | 1277.8 | Riffle | Dry | |
| 111 | 72.9 | 1283.4 | Riffle | Dry | |
| 112 | 76.4 | | Riffle | Dry | |
| 113 | 87.8 | 1286.7 | Riffle | Dry | |
| 114 | 98.5 | 1290.4 | Riffle | Dry | |
| 115 | | | | | |
| 116 | Tributary | | | | |
| 117 | 0.0 | 1306.7 | Pool | Dry | |
| 118 | 3.1 | | | Dry | |
| 119 | 7.9 | | | Dry | |
| 120 | 12.4 | 1311.9 | Riffle | Dry | |



| Point | Distance | Elevation | Stream | Water depth | Bankfull |
|-------|--------------|-----------|----------------|-------------|----------|
| | from Beg(ft) | (ft) | Characteristic | (Tenths) | (Tenths) |
| 121 | 13,6 | 1311.4 | Pool | Dry | |
| 122 | 17.2 | 1313.9 | Riffle | Dry | |
| 123 | 21 | 1314.5 | Riffle | Dry . | |
| 124 | 22.9 | 1314.2 | Pool | Dry | 1.2 |
| 125 | 25.6 | 1315.9 | Riffle | Dry | |
| 126 | 27.2 | 1315.6 | Pool | Dry | |
| 127 | 30.8 | 1316.8 | Riffle | Dry | |
| 128 | 35 | 1317.1 | Riffle | Dry | |
| 129 | 39.3 | 1317.7 | Riffle | Dry | |
| 130 | 48.8 | 1319.1 | Riffle | Dry | |
| 131 | 51.4 | 1320 | Riffle | Dry | |
| 132 | 53.8 | 1319.5 | Pool | Dry | |
| 133 | 56.1 | 1320.9 | Riffle | Dry | |
| 134 | 57.2 | 1320.7 | Riffle | Dry | |
| 135 | 59.5 | 1321.8 | Riffle | Dry | |
| 136 | 69.8 | 1324.6 | Riffle | Dry | |
| 127 | 74.9 | 1327.7 | Riffle | Dry | |
| 138 | 77.1 | 1327.8 | Riffle | Dry | |
| 139 | 79.1 | 1328.9 | Riffle | Dry | |
| 140 | 87.9 | 1332.2 | Riffle | Dry | |
| 141 | 97.8 | 1334.1 | Riffle | Dry | |
| 142 | 100.6 | 1334.7 | Riffle | Dry | |
| 143 | 103.2 | 1335 | Pool | Dry | 0.7 |
| 144 | 106.3 | 1337.3 | Riffle | Dry | |
| 145 | 109 | 1336.9 | Pool | Dry | |
| 146 | 113.4 | 1339.9 | Riffle | Dry | |
| 147 | 117.3 | 1340.9 | Riffle | Dry | - |
| 148 | 119.6 | 1342.3 | | Dry | |
| 149 | 126.5 | 1342.9 | | Dry | |
| 150 | 128.1 | 1344.3 | | | 0.6 |

(Family Level Taxonomy - Riffle Only Sample)

Nally & Hamilton (Permit No. 860-0380, Am

Project ID:

#6)

Stream/Reach:

HF-15

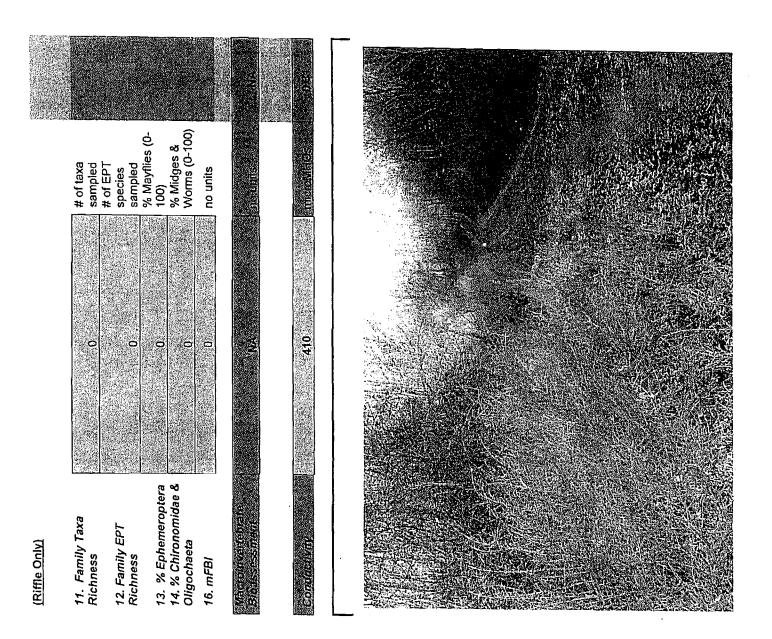
Unnamed Tributary to Defeated Creek

Assessment Objectives:

| EII | · | Model | |
|------|---|-------|--|
| | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) | | |
| 0.20 | Ecological Integrity Index (Habitat Integrity + Conductivity) | | |

Variables Measure Units **RBP Habitat** <u>Parameters</u> 4 1. Epifaunal Substrate no units (0-20) 6 2. Embeddedness no units (0-20) 3. Velocity/Depth Regime no units (0-20) 4. Sediment 6 Deposition no units (0-20) 5. Channel Flow Status no units (0-20) 5 6. Channel Alteration no units (0-20) 7. Freq. Of Riffles 19 (bends) no units (0-20) 8. Bank stability (both 6 combined) no units (0-20) 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20)







(Family Level Taxonomy - Riffle Only Sample)

Nally & Hamilton (Permit No. 860-0380, Am

Project ID:

#6)

Stream/Reach:

Pond 106

Unnamed Tributary to Defeated Creek

Assessment

Objectives:

| EII | Model |
|------|--|
| ŃA | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) |
| | Ecological Integrity Index (Habitat |
| 0.20 | Integrity + Conductivity) |

Variables Units Measure **RBP Habitat Parameters** 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 3. Velocity/Depth Regime no units (0-20) 4. Sediment Deposition no units (0-20) 5. Channel Flow 10 Status no units (0-20) 6. Channel Alteration no units (0-20) 7. Freq. Of Riffles (bends) no units (0-20) 8. Bank stability (both combined) no units (0-20) 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20)

Total Habitat Score

kab*ustlin*egniyande

36

no units Subindex

Macroinvertebrate

Data - Family Level



| (Riffle Only) | | | |
|--|--|-------------------------------------|--|
| 11. Family Taxa Richness | 0 | # of taxa sampled # of EPT | |
| 12. Family EPT Richness | 0 | species sampled % Mayflies (0- | |
| 13. % Ephemeroptera 14. % Chironomidae & Oligochaeta | 0° | 100) % Midges & Worms (0-100) | |
| 16. mFBI | (A) (B) (B) (B) (B) (B) (B) (B) (B) (B) (B | no units | |
| Macroinverteurate Broassessment | NA . | inje únike | 200 (100 (100 (100 (100 (100 (100 (100 (|
| Gönductivity | 410 | THE TOTAL FOR | an organiza |





(Family Level Taxonomy - Riffle Only Sample)

Nally & Hamilton (Permit No. 860-0380, Am

Project ID:

#6)

Stream/Reach:

HF 16

Sugar Branch

<u>Assessment</u> Objectives:

| E!! | | Model |
|------|--|-------|
| NA | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) | |
| 0.38 | Ecological Integrity Index (Habitat Integrity + Conductivity) | |

Variables Measure Units **RBP** Habitat <u>Parameters</u> 10 1. Epifaunal Substrate no units (0-20) 10 2. Embeddedness no units (0-20) 3. Velocity/Depth 9 Regime no units (0-20) 4. Sediment Deposition 10 no units (0-20) 5. Channel Flow Status no units (0-20) 9 6. Channel Alteration no units (0-20) 7. Freq. Of Riffles 19 (bends) no units (0-20) 8. Bank stability (both 8 combined) no units (0-20) 9. Veg. Protection 10 (both combined) no units (0-20) 10. Riparian Width no units (0-20) (both combined) Total Habitat Score

Habitet Integrity India

no units

Subindex

Macroinvertebrate Data - Family Level



| 0 0 | # of taxa sampled # of EPT species sampled % Mayfiles (0-100) % Midges & Worms (0-100) no units | Allenation | olio serioli etta | 16. mFBI | 14. % Chironomidae & Oligochaeta | 13. % Ephemeroptera | 12. Family EPT Richness | 11. Family Taxa Richness | |
|------------------|---|------------|-------------------|----------|----------------------------------|---------------------|----------------------------|-----------------------------|--|
| 0 0 0 0 | | | | | | | | | |
| | # of taxa sampled # of EPT species sampled % Mayflied 100) % Midges Worms (0- | 27.0 | N. | Ō | 0 . | 0 . | 0 | 0 | |
| | # of taxa sampled # of EPT species sampled % Mayflies 100) % Midges Worms (0- no units | | | | | | /F3 2 5% | | |



(Family Level Taxonomy - Riffle Only Sample)

Nally & Hamilton (Permit No. 860-0380, Am

Project ID:

Stream/Reach:

Pond-107

Sugar Branch

<u>Assessment</u> Objectives:

| EII | | Model |
|-------|--|-------|
| NA NA | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) | |
| 0.39 | Ecological Integrity Index (Habitat Integrity + Conductivity) | |

Variables Measure Units RBP Habitat <u>Parameters</u> 13 1. Epifaunal Substrate no units (0-20) 10 2. Embeddedness no units (0-20) 3. Velocity/Depth 10 Regime no units (0-20) 4. Sediment 10 Deposition no units (0-20) 5. Channel Flow 9 no units (0-20) Status 9. 6. Channel Alteration no units (0-20) 7. Freq. Of Riffles 19 (bends) no units (0-20) 8. Bank stability (both 8 combined) no units (0-20) 9. Veg. Protection 10 (both combined) no units (0-20) 10. Riparian Width 4 (both combined) no units (0-20) Total Habitat Score Subindex no units Salatar Integral y Index

<u>Macroinvertebrate</u> Data - Family Level



12. Family EPT Richness 11. Family Taxa Richness (Riffle Only) 270 # of taxa
sampled
of EPT
species
sampled
% Mayflies (0100)
% Midges &
Worms (0-100)





(Family Level Taxonomy - Riffle Only Sample)

Nally & Hamilton (Permit No. 860-0380, Am

Project ID:

Stream/Reach:

HF-17

Unnamed Tributary to Carr Creek Lake

Assessment Objectives:

> EII Model Ecological Integrity Index (MBI + Habitat NA Integrity + Conductivity) Ecological Integrity Index (Habitat 0.25 Integrity + Conductivity)

Variables Units Measure **RBP Habitat** <u>Parameters</u> 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 3. Velocity/Depth 9 no units (0-20) Regime 4. Sediment 9 no units (0-20) Deposition 5. Channel Flow 0 Status no units (0-20) 12 6. Channel Alteration no units (0-20) 7. Freq. Of Riffles 19 (bends) no units (0-20) 8. Bank stability (both 6 combined) no units (0-20) 9. Veg. Protection 10 (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20) Total Habitat Score Subindex no units

45

Macroinvertebrate Data - Family Level



(Family Level Taxonomy - Riffle Only Sample)

Nally & Hamilton (Permit No. 860-0380, Am

Project ID:

#6)

Stream/Reach:

Pond 92

Unnamed Tributary to Carr Creek Lake

Assessment Objectives:

| EII | | Model | |
|------|--|-------|--|
| | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) | | |
| 0.25 | Ecological Integrity Index (Habitat Integrity + Conductivity) | | |

Variables Units Measure **RBP Habitat** <u>Parameters</u> 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 3. Velocity/Depth Regime no units (0-20) 4. Sediment Deposition no units (0-20) 5. Channel Flow Status no units (0-20) 6. Channel Alteration no units (0-20) 7. Freq. Of Riffles (bends) no units (0-20) 8. Bank stability (both combined) no units (0-20) 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20)

Total Habitat Score

2 no units

Subindex

sancalinicana histori



| Inputs | Tima Horizon: | 76 | • | cted Site | 9 | | | | | Mi | igation S | ite | | | |
|----------------|--------------------|---------|-----------------|--------------------|--------|--------------------|---|--|---|---------------------|-----------------------|------------------------------|----------------------|----------------------|------------------|
| Project (Q # ; | 03£0 -038 ± SHO | A6 | Ecological Inte | osc 2007 | | | Mitigatio | n Work Timing & | Risk | | E | cological integrity | Index | | |
| Project Name: | Sugar Bran | nch | | | Langth | Balance | | Yeer Sturled | Yeer Me | lured Fallura R | ak Pse-Wosk | | | Miligadon | Midgedon |
| lmpa | act Reach (IR): | : | Pre-Impact | Post- Impact | (n) | (ft) | Mitigation Reach (MR) Name | | _ (' | | | Immediately After Work | At Maturity | (Length Required) | (Length Offered) |
| H | F;15 (ephemeral) | | 0.20 | 0.00 | 665 | | HF 15 (eptiemeral) | 2007 | 20 | 0 5 | 0.00% | 0,32 | 20.37 | 386 | 386 |
| R | each Continued | | 0.20 | 0.00 | | 0 | | | | | | | 100 | #DIV/0! | |
| | #DIV/01 | | #DIV/01 | #DIV/01 | | #DIV/01 | | | | | | | | #DIV/01 | 198 3 8 1 1 2 |
| | #DIV/01 | | #DIV/01 | #DIV/01 | | #DIV/01 | | - Pin a market 1,, 11, 12 and 1 | | | | | | #DIV/01 | 46 |
| | #DIV/01 | | #DIV/01 | #DIV/0! | il. | #DIV/01 | Year of the second | | | | | | | #DIV/01 | |
| | #DIV/0I | | #DIV/01 | #DIV/01 | | #DIV/01 | | | | | | | | #DIV/01 | |
| | #DIV/01 | | #DIV/01 | #DIV/01 #DIV/01 | ٥ | #DIV/01 #DIV/01 | | | | | H | | - | #DIV/01 | |
| | #DIV/01 | | #DIV/01 | | ą. | #DIV/01 | | | 11/10/201 | | H | H | | #DIV/01 | |
| | #DIV/01 #DIV/01 | | #D(V/0) | #DIV/01 | · · | #DIV/01 | | Married Company of the Company of th | 100000 | | | | | #DIV/01 | C.C |
| Outputs |] | | | | | ical Intersation R | | Ratio | 11 | | project im | | restiona (ear) | | |
| Impact Reach | ı vs | | | | | | (mitigation site feet | • | b) Es | timate the Ecol | ogical integrity (| EII) prior to project im | pacts (i.e., Pre-In | npact) | |
| Mitigatio | on Reach | | | | | | | per impact site foot | c) Pr | dict Ecologica | integrity (Ell) at | Her the proposed impo | icts occur (i.e., P | ost-impact) | |
| IR v | s MR1 | | | | | | | » 0.58 | d) Pres | cribe the length o | stream teach tebre | ssented by this proposed is | mpaci | | |
| IR v | s MR2 | | | | | | | note 15) ##DIV/0] | 2) <u>D</u> | scribe the | proposed | mitigation use | d to offset | proposed | impacts: |
| #1 |)(V)()! | #DIV/01 | #DIV/01 | | | | #DIV/O[注 e) Indicate when the proposed mitigation will take place (i.e., Year Started) | | | | | | | | |
| #0 | DIV/OI | #DIV/0! | #DIV/01 | | | | | #DIV/01 | b) Pres | fict when the mitty | stion project will re | sch meturity (i.e., Year Mai | nteq) | | |
| #[| N/VIC | #DIV/01 | #DIV/01 | | | | NOTIFIED ADITION C) Estimate the Risk of Fellure for the specific proposed mitigation site and plan | | | | | | | | |
| #[| DIVIDI | #DIV/01 | #DIV/0) | | | | aDIVIN | | | | | | | | |
| ₩E | DIV/01 | #DIV/01 | #DIV/01 | | | | | #DIVIO | dogs (i.e. Pre-Work) Immediatoly After Work and At Naturity | | | | | | |
| #1 | וויוסועום | #DIV/01 | #DIV/01 | _ _ | | . | | 101V/ICH INVIOL | a) indicate the linear distance of the proposed mitigation offered to offset proposed impacts | | | | | | |
| #1 | DIV/01 | #DIV/01 | #DIV/0! | | | | | rows: #DIV/01 | . Offer | cessery, (Indicate | by e balance > 0 i | n Column P), continue with | additional mittgatio | n sitos | |
| #1 | DIV/0I | #DIV/01 | #DIV/01 | | | | | IDIVIOR #DIVIOR | A Company | | | User | Notes: | | |
| | | | | 4 (4) | | | | | 1) បទ | er only need | ls to lill out t | he gray shaded bo | es cox | | |
| | | | 1.50 | | | | | | 🎳 2) Us | e a separate | spreadshee | t for each homoge | neous Impac | t reach to be | e mitigated |

| Inputs | Time Hodzon: | 76 | • | cted Site |) 1 | | | | | Mitiç | gation Site | e , | | | |
|---------------|-------------------|---------|------------------|--------------------|---------------------------------------|---------|---|------------------|---|--|-----------------------------------|--|--------------------|----------------------|--|
| Project IDS: | DNR # 880-03 | 8D, A.6 | Ecological Inter | | | | Mitigation W | ork Timing & | Risk | | Eco | logical integrity i | ndex | | |
| Project Name: | Sugar Bra | anch | | | Length | Balance | | Year Started | Year Malured | Feilura Diak | Pre-Work | | | Hitigation | Miligation |
| lmpa | ict Reach (IR |); | Pre-Impact | Post- Impact | (ft) | (11) | Midgation Reach (MR) Name | | | | 1 1 1 | Immedialely Alter Work | At Maturity | (Longth Required) | (Length Offered) |
| HE | 15 (Intermittent) | | 0.20 | 0.00, | 1064 | | SS 106 | 2010 | 2040 | 50 % | 0.10 | × 0.38 | 0,43 | 739 | 72 |
| Re | ach Continued | | 0,20 | 0,00 | : | 960 | SS 92 | 2010 | 2040 | \$ 50 | 0:10 | 0.30 | 0.34 | 927 | 29 |
| Re | each Continued | | 0.20 | 0.00 | Ŷ | 930 | Section 1997 | | | 1000 | 100 | | | #DIV/01 | no de la companya de |
| | #D)V/01 | | #DIV/DI | #DIV/01 | 4 | #DIV/01 | | | | 1888 | | | | #DIVIQE | |
| | #D)V/01 | | #DIV/01 | #D)V/01 | | #D V/0I | | 107576202 | | 建設数 | 60760000 | | 12.60 | #DIVIOI | |
| | #DIV/01 | | #DIV/01 | #DIV/01 | | #DIV/01 | | | | | | | | #DIV/01 | |
| | #DIV/01 | | #DIV/01 | #DIV/01 | 72 | #DIV/01 | | | | | | Site and Control | | #DIV/01 | 11 2 40 2 2 2 |
| | #DIV/01 | | #DIV/01 | #DIV/01 | | #DIV/0! | | | | | | | | #DIV/01 | |
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| Outputs | | | | | Ecologi Compen | | | Ratio | | | project Impa pact(s) will take | <u>instru</u> acts: place (i.e., impact Yo | | | |
| Impact Reach | vs | | , | | | | (mitigation site feet | | b) Estimate | e the Ecologi | ical Integrity (EII) |) prior to project Imp | acts (I.o., Pre-In | ipact) | |
| Mitigatio | n Reach | | | | | | | mpact site foot) | c) Pradict I | Ecological in | tegrity (EII) after | the proposed impac | ts occur (i.e., P | ost-Impact) | |
| IR v | s MR1 | | | | | | | 0.69 | d) Prescribe (| the length of st | teem teech lebterei | nlad by this proposed im | pect | | |
| IR v | s MR2 | | | | · · · · · · · · · · · · · · · · · · · | | 2) Describe the proposed mitigation used to offset proposed impacts | | | | | | | mpacts: | |
| IR v | s MR3 | | | | | | (see note 15) ##DIV/OI | | | | | | | | |
| #0 | IV/01 | #DIV/01 | #DIV/01 | | | | aDN/N(新DN/O) b) Predict when the mitigetion project will seach maturity (i.e., Year Metured) | | | | | | | | |
| #0 | 1V/0t | #DIV/0! | #DIV/01 | | | | #DIVIO) #DIVIO) | | | | | | | | |
| #0 | 1V/01 | #DIV/01 | #DIV/01 | | | | #DIV/OIX d) Estimate the Ecological Inlegitly of the proposed mitigation site before any work is | | | | | | | | |
| #0 |)(V/01 | #DIV/0! | #QIV/01 | | | | *Df | #DIV/01 | done (i.e., Pre-Work), immediately Altas Work, and At Maturity | | | | | | |
| #C |)(V/0) | #DIV/01 | #DIV/01 | | | | 101 | /a #DIV/01 | VIOID s) Indicate the Breef distance of the proposed miligation offered to offset proposed impacts | | | | | | |
| #0 | 10/VIC | #DIV/01 | #DIV/01 | | | | 107 | m wildivions | DIMO 1) If necessary, (Indicated by a balance > 0 in Column P), continue with additional miligation sites | | | | | | |
| #0 | וסיעוכ | #DIV/01 | #DIV/01 | | | | #DI | m #OVIO | | | • | User | Notes: | | |
| 4 * . | | | | | | | | | 1) User o | nly needs | to fill out the | gray shaded bo | | | |
| | | | | | | | | | 2) Use a t | separate s | preadsheet fo | or each homoge | neous impaç | t reach to be | mitigated |

Stream Compensation Ratio Calculator Version 3.4

| Inputs | Time Horizon: | 76 | • | cted Site | } } | | | | | | Miti | gation Site | 9 | | | . : |
|----------------|--------------------|---------------------|---|--|-------------|------------------------|--|--|--|--|------------------|------------------------|--------------------------------|--------------------|----------------------|------------------|
| Project (O # ; | DNR # 850-018 | 0, A B | Ecological Integ | grity Index | | | the state of | Mitigation Wo | ork Timing & | Risk | | <u>Eco</u> | logical integrity i | index | | |
| Project Name: | Sugar Bra | nch | | | Length | Balance | | erani. Na mengelen | Year Stantad | Yaar Malurad | Fallure Rish | Pre-Work | e Authorizada | | Mitigation | Mitigation |
| | act Reach (IR) | otennolisariamisso. | Pre-Impact | Post- Impact | (ft) | (ft) | Miggation Reach | 4 444180 - | Majorit yas | | nis jajartu | | Immediately After Work | At Maturity | (Length Required) | (Length Offered) |
| | SS 1067 | | 0,20 | 0:10 | 112 | _ | SS 10 | | 2010 | 2040 | | 010 | 0.38 | 0.43 | 39 | *\$39¥4° |
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| | #VALUEI | | ###################################### | ###################################### | * | #VALUE! | | | | Charles and Charles | | | AND THE PERSON NAMED IN COLUMN | | #VALUE! | |
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| | #VALUEI | | ###################################### | 14/14/14/14 | Ì | #VALUE! | 0. | | 0.00 | | | | | 1650, 11 1645 | #VALUE! | |
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| Oulputs | | | | | | ical Integ sation R | | | Ratio | | | project impa | | ctions | | |
| Impact Reach | h vs | | | | | | (mitigation site fee | | Ttatio | a · | | | prior to project imp | | spact) | |
| Mitigatio | on Reach | | | | | | limidation site int | | pact site foot) | c) Predict | Ecological In | ntegrity (Ell) after | the proposed Impa | cts occur (l.a., P | (isagmì-tao | |
| IRV | vs MR1 | | | | | | | | 0.35 | d) Prescribe | the length of at | nestu tesch tebisser | nted by this proposed in | npact | | |
| | | | | | | | | | | 2) <u>Desci</u> | ribe the j | proposed m | nitigation used | d to offset | proposed i | impacts: |
| #V/ | ALUEI | #VALUE! | ######## | | | | #VALUELS#VALUE) a) Indicate when the proposed militation will take place (i.e., Year Started) | | | | | | | | | |
| #V/ | ALUEI | #VALUE! | ####### | | | | | AVALU | #VALUE! | 100022 | | | | | | |
| | ALUEI | #VALUE! | ######## | | | | | | #VALUE | c) Estimate (| he Riek of Falls | ure for the specific p | rapossa initigation sila : | end plan | | |
| | ALUEI | #VALUE! | ######## | | | | SYALUEI (RVALUE) d) Estimate the Ecological Integrity of the proposed mitigation elfa before any work is | | | | | | | | | |
| | ALUEI | #VALUEI | ###################################### | | | | | | #VALUEI | done (l.e., | Pre-Work), kno | nedialaly Aflar Work | , and At Maturity | | | |
| #V | ALUEI | #VALUE! | *************************************** | | | | | #VALU | E #VALUE | ALQEII a) Indicate the linear distance of the proposed mitigation offered to offset proposed impacts | | | | | | |
| #V | 'ALUEI | #VALUE! | ####### | | | | | | e #VALUE | | | | | | | |
| #V | ALUE) | #VALUE! | ######## | | | | | | E #VALUE! | | | | User | Notes: | | |
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| | 12 | | | | | | | | | 2) Use a | separate e | preadsheet fo | or each homoge | neous impac | t reach to be | mitigated |

Stream Compensation Ratio Calculator Version 3.4

| Stream | Compensa | 21011 | TOUT OF | uiat | O1 46 | . 31011 | | | | | | | · | | | |
|----------------------------|--|----------------------------|--|--|------------------------|-------------------------|--|--|--|----------------|--|---------------------|-----------------------------|-------------------|----------------------|------------------|
| Inputs | Time Horizon: | 76 | lmpa | cted Site | e | | , | ** | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | Mitig | ation Sit | e - | | • | ut. |
| | <u> </u> | | Impact Ye | ean s 2007st |] | | | \$ 1 | • . | | ing in the second of the secon | · | _ : | · | 1 | |
| Project (D#; | DNR # 860-0380, A | 4.6 | Ecological Injury | grity index | | | | Mitigation V | Vork Timing & | Risk | | <u>Eco</u> | logical Integrity I | <u>ndex</u> | | |
| Project Name: | Sugar Brand | ch | | | Length | Balance | | | | | | | | | Miligation | Miligation |
| lmpa | act Reach (IR): | ni-romania - | Pro-Impect | Post- Impact | (ff) | (H) | Midgation | Reach (MR) Name | Year Startad | Year Hallind | Falling Risk | Pro-Work | Immediately After Work | At Maturity | (Longth Regulred) | [Langth Offered] |
| L COST H | (F.16 (aphamarai) | | 30.38 | 0.00 | 814 | | HF 16 | (ephemeral): | 2007 | 2010 | 50 | 0.00 | 0.30 | 0.35 | 963 | 953 |
| , Ri | each Continued | 1127 | 0.38 | 0.00 | | 0 | | | | | | | | | #DIV/01 | |
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| Outrute | 7 | | | | Ecolog | ical Inte | grity | | | | | | Instru | ctions | | |
| Outputs | _ | | | | Comper | isation R | latios | | D-4:- | | | <u>roject imp</u> | | | | |
| | | | | | | | | | <u>Ratio</u> | | | • | place (i.e., impact Y | | | |
| Impact Reach | | | | | | | (mitigation s | | | ' | _ | |) prior to project imp | • • | | |
| | on Reach | | | | | | | per | impact site foot) | ₩. | - | | r the proposed Impac | | ost-mpact) | |
| IR v | vs MR1 | <u> </u> | | | | | a) Prescribe the length of stream reach represented by this proposed impact (22.20.10.40) 40(1/10) 2) Describe the proposed mitigation used to offset proposed in | | | | | | | | 1 | |
| | vs MR2 | | | | | | | | 15 #DIVIO | | | | | | proposed | impacts: |
| #0 | DIV/01 | ומועום# | #DIV/DI | | | | | | Wor #DIVIOI | - | | • | ke piece (î.e., Year Starte | | | |
| #0 | DIV/0I | #DIV/01 | #DIV/01 | | | | | \$ D | va⊨ #DIV/01 | b) Predict wh | ten the mittgetto | n project will read | h malurity (f.e., Year Malu | ied) | | |
| #0 | DIV/0! | #D(V/01 | #DIV/01 | | | | | #DIV/01 c) Estimate the Risk of Failure for the specific proposed mitigation sits and plan | | | | | | | | |
| #0 | DIV/01 | #DIV/01 | #DIV/0! | | | | | in | HDIV/01 | d) Eetimata U | he Ecological in | tegrity of the prop | osed miligation site belo | ra any work is | | |
| #0 | DIVIOI | #DIV/0! | #DIV/01 | | | | | gw. | rvail #D)V/01 | dens (l.e., l | Pre-Work), know | ediatoly Atlas Work | , and Al Maturity | | | |
| #1 | DIV/01 | #DIV/01 | #DIV/01 | | | | | #0 | IVAL #DIV/OI | e) Indicate th | ho linear distanc | a of the proposed | miligation offered to offe | at proposed impac | le . | |
| #1 | DIV/OI | #D1V/01 | #DIV/01 | | 0 | | | | 1V#1 \$#DIV/01 | | | | olumn P), continue with | | | |
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2) Use a separate spreadsheet for each homogeneous impact reach to be mitigated

1) User only needs to fill out the gray shaded boxes

| Inputs | Time Harizon; | 76 | • | cted Site | ; } | | | 4 f s | | | Miti | gation Site | 3 | | | |
|----------------|---------------------|---------|------------------------|--------------------|-------------------|--------------------|---|--|---|------------------|-----------------|------------------------------------|----------------------------|--------------------|----------------------|-------------------|
| Project (D # ; | DNR # 860-038 | 0, A.6 | Ecological inter | nity Index | | | Mitigation | Work Timi | ng & F | Risk | | <u>E</u> col | ogical Integrity | ndex: | | |
| Project Name: | Sugar Bra | nch | | | Length | Batance | | Year Su | nted | Year Matered | Fallure Risk | Pre-Work | | | Mittgetion | Hillgelian |
| <u>lmpa</u> | ct Reach (IR) | : | Pre-Impact | Post- Impact | (11) | (ft) | Mittgation Reach (MR) Name | | | | | | Immediately Alter Work | At Meturity | (Length Required) | (Length Olfered) |
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| Impact Reach | vs | | | | | | (miligation site feet | | | b) Estimate | the Ecolog | Ical Integrity (EII) | prior to project imp | acts (l.e., Pro-Im | ipact) | |
| Mitigatio | n Reach | <u></u> | | | | | | er impact site | foot) | | • | | the proposed impa | • | ost-Impaci) | |
| IR v | s MR1 | | | | | | (see | 101e 151 # (D) | 101 | d) Prescribe th | he length of s | heam teach tebteeu | ted by this proposed in | npa¢(| | |
| #D | IV/01 | #DIV/01 | #DIV/01 | | | | | Olve: #DI | //01: | 2) <u>Descri</u> | ibe the | proposed m | <u>iitigation use</u> | d to offset r | proposed | impacts: |
| D# | IV/01 | #D1V/01 | #DIV/01 | | برخصي | | #DIVIOR a) Indicate when the proposed miligation will take place (i.e., Year Started) | | | | | | | | | |
| #D | IV/01 | #DIV/01 | #DIV/01 | | | | | rolva: #DI\ | lois | b) Predict whe | n the mittget | on project will reach | malipity (i.a., Year Met | (1 4 8) | | |
| # | 1V/01 | #DIV/0! | #DIV/0[| | | | | IDIV. | //01\$ | c) Estimate th | e Rûsk ol Feli | ure for the specific pr | roposed mitigation elte | and plan | | |
| #D |)IV/01 | #DIV/0! | #DIV/01 | | | | | IDIVIOI #DI | A) Estimate the Ecological integrity of the proposed mitigation alta before any work is | | | | | | | |
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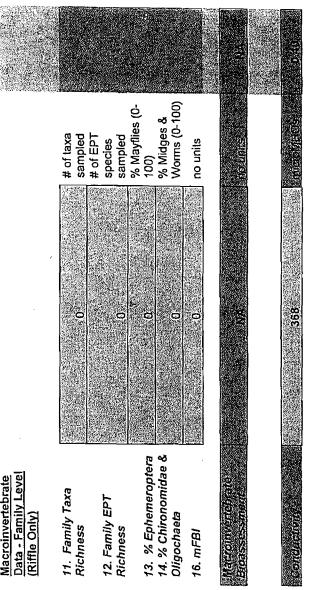
Stream Compensation Ratio Calculator Version 3.4

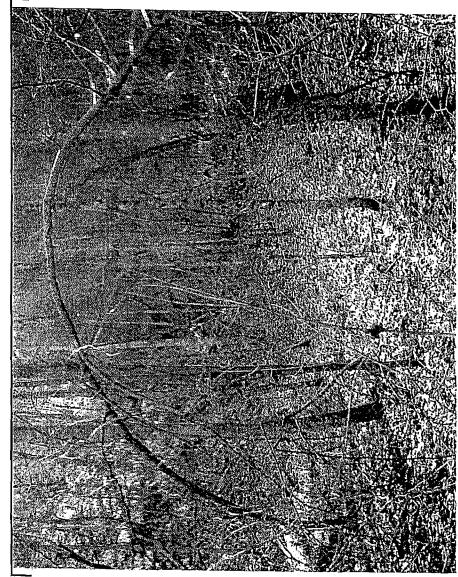
| nputs | Time Horizon: | 75 | Impa | cted Site | • | | | | • | Mitig | ation Site | 9 | | | |
|--------------|-------------------------|---|--------------------|--------------------|--------|--------------------|----------------------------|-------------------|---|------------------|----------------------------------|----------------------------|----------------------|------------------------------|------------------|
| · | | | Impact Ye | ar 2007 | | | | | 1 | | | | | | |
| ojact ID # : | DKR # 860-0380 | , A.6 | Ecological Integ | rity index | | | Mitigation V | Vork Timing & | Risk | 14 (1) 14 (1) | <u>Eco</u> | logical Integrity | ndex | | : |
| olect Name; | Sugar Brai | ich | | | Length | Balance | | Yeer Sterled | Your Matured | Fallure Flak | Pre-Work | | | notegill | rangradou |
| lmpa | act Reach (IR): | | Pre-Impact | Post- Impact | (ft) | (ft) | Miligation Reach (MR) Name | | | | | tramedialely Aller Work | At Maturity | (<u>Length</u> Required) | (Length Offered) |
| | S9 107. | | 0,39 | 0,10 | 135 | | SS.107 | 2010 | 2040 | €60 % | 0.10 | 0.38 | 0.43 | 136 | 135 |
| Re | each Continued | | 0,39 | 0.10 | | 1 . | \$3,106 | 2010 | 2040 | 60 | 0,10 | 0.38 | 0.43 | 1 | |
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| Outputs | | | | | | ical Intersation R | | Ratio | | | roject imp: pact(s) will take | | ictions 'ear) | | |
| impact Reach | 1 | | | | | | (mitigation site feet | | U . | - | | prior to project imp | • | | |
| Mitigatio | on Reach | | | | | | <u> </u> | Impact site foot) | -((| - | | the proposed impa | • | ost-Impact) | |
| IR v | s MR1 | | | | | | | » 101 | 41 | _ | | nted by this proposed in | | | |
| IR v | s MR2 | | | | | | | × 31,01 | 2) <u>Descr</u> | ibe the p | roposed n | <u>itigation use</u> | d to offset | proposed | Impacts: |
| JR v | s MR3 | | | | | | (see and | n 選#DIVIDIS | e) indicate wh | en the propose | d mitigation will to | ke place (I.e., Year Start | ed) | | |
| #0 | NV/OI | #DIV/01 | #DIV/01 | | | | lo lo | wei ##DIV/01 | b) Predict wh | en the mitgado | n project will reach | maturity (i.e., Year Mat | nusq) | | |
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| #0 | DIV/OI | #DIV/01 | #DIV/01 | | | | | IOIVION INVI | d) Ealimaia ti | ie Ecological (a | legilly of the propo | osed mitigation sile befo | ni aný work la | | |
| #t | OIV/01 | #DIV/01 | #DIV/01 | | | | ¥0 | ivoi "#DIV/0i | done (i.s., Pre-Work), Immediately After Work, and At Maturity | | | | | | |
| #0 | OIV/0I | #DIV/01 #DIV/01 s) Indicate the linear distance of the proposed miligation offered to offset prop | | | | | | | | | | set proposed Impac | l a | | |
| #0 | 01V/01 | #DIV/0! | #DIV/01 | | | | 5 0 | MDIVIOL | f) if necessar | y, (indicaled by | a balance > 0 in C | olumn P), continue with | additional miligatio | فطاه م | |
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| #L | | | | | | | | | User Notes: 1) User only needs to fill out the gray shaded boxes | | | | | | |

2) Use a separate spreadsheet for each homogeneous impact reach to be mitigated

stream Compensation Ratio Galculator Version 3.4

| Inputs | Time Hodzon: | 76 | - | cted Site |) } | _ | | | | Mitig | gation Sit | e | | | |
|---------------|--------------------|---------|------------------------|--------------------|--------|--------------------|--|-----------------|---|------------------|------------------------|---------------------------------------|--------------------|----------------------|---------------------------|
| Project ID#; | DNR ≠ 060-034 | 80, A.6 | <u>Ecological Inte</u> | nity index | | | Mitigation Wo | rk Timing & | Risk | | Eco | logical integrity i | ndex | | |
| Project Name; | Sugar Bra | anch | | | Length | Balance | | Year Started | Year Mahured | Fallu/e Risk | Pre-Work | er i 17. Hej er en jedest | | Miligation | Milligation |
| Impa | act Reach (IR |): | Pre-Impact | Post- impact | (m) | (11) | Mitigation Reach (MR) Name | | | | 6666.44 | krumedielsly After Work | At Maturity | (Length Required) | (Length Offered) |
| H | F.17 (ephemeral) | | 0.25 | 0.00 | 684 | | HF 17 (ophomeral) | 2007 | 2010 | 60 | 0.00 | 0.30 | 0,34 | 535 | 635 |
| Re | each Continued* | | 0.25 | 0.00 | | 0 | | | | | | | | #DIV/01 | |
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| Outputs | | | | | | ical Inte | | | | | | | ctions | | |
| Omputs | 1 | | | | Compen | sation R | tatios | Ratio | ıı - ——— | | project imp: | <u>3CtS:</u> place (i.e., Impact Y | ear) | | |
| Impact Reach | ı vs | | | | | | (miligation site feet | | b) Estimat | e the Ecolog | ical Integrity (Ell |) prior to project Imp | scts (i.e., Pra-in | npact) | |
| Mitigatio | on Reach | | | | | | • - | pact site foot) | e) Prodict | Ecological Ir | itagrity (Ell) ofter | the proposed impac | ds occur (i.e., P | ost-impact) | |
| IR v | s MR1 | | | | | | >===================================== | 0.78 | d) Prescribe | the length of st | ream reach represe | ureq på ryje bioboseq pu | paci | | |
| IR v | s MR2 | | | | | | (see note 15 | #DIV/OI | 2) <u>Desc</u> i | ribe the j | oroposed m | iltigation used | to offset | proposed | mpacts: |
| #0 | DIV/Ot | #DIV/01 | #DIV/01 | | | | a) indicate when the proposed militgation will take place (i.e., Year Started) | | | | | | | | |
| #0 | DIV/0I | #DIV/01 | #DIV/0I | | | | #DRV/D | #DIV/01 | b) Predict wi | hen the mitigati | on project will reach | maturity (I.a., Year Matu | red) | | |
| #0 | 01V/01 | #DIV/01 | #DIV/01 | | | | MDRV/RI | #DIV/01 . | c) Estimala i | he Risk of Failt | ure for the epecific p | roposad miligation alla : | end plan | | |
| #0 | DIV/01 | #DIV/01 | #DIV/01_ | | | | #DIV/01# of Fellmale the Ecological Integrity of the proposed mitigation also before any work to | | | | | | | | |
| #0 | OIV/01 | #D)V/01 | #DIV/01 | | | | | #DIV/01 | done (i.e., Pre-Work), Immediately Alter Work, and At Maturity | | | | | | |
| #0 | OIV/01 | #DIV/01 | #DIV/01 | | | | #D(V)A | #DIVIOL | 1/101% e) Indicate the linear distance of the proposed mitigation offered to offer proposed Impacts | | | | | | |
| #0 | DIV/0I | #D1V/0! | #DIV/01 | | | | NOVA . | #DIVIOI | | | | | | | |
| 7# | DIV/01 | #DIV/01 | #DIV/01 | | | | MOIVE | #DIVIOI» | | | | <u>User</u> | Notes: | | |
| | | | | | | | | | 1) User o | nly needs | to fill out the | gray shaded bo | Xes | | |
| | | | | | | | to the second of the second | 在1 5年间 | 2) Use a | separate s | preadsheet fo | or each homoge: | neous Impac | t reach to be | mitigated |







Appendix H

Ell Calculation Five Years after Restoration



Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6)

Stream/Reach: HF-15

Assessment Objectives: Immediately after restored

| | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) | | |
|------|---|---|--|
| 0.32 | Ecological Integrity Index (Habitat Integrity + Conductivity) | _ | |

Variables

Measure

Units

no units

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

RBP Habitat Parameters

- 1. Epifaunal Substrate
- 2. Embeddedness
- 3. Velocity/Depth Regime
- 4. Sediment Deposition
- 5. Channel Flow Status
- 6. Channel Alteration
- 7. Freq. Of Riffles (bends)
- 8. Bank stability (both combined)
- 9. Veg. Protection (both combined)
- 10. Riparian Width (both combined)

| | _ |
|------------|-----------------|
| 47 | no units (0-20) |
| 17. | no units (0-20) |
| 10 | no units (0-20) |
| 17 | no units (0-20) |
| 1 2 | no units (0-20) |
| 15 | no units (0-20) |
| - 20 | no units (0-20) |
| 18. | no units (0-20) |
| 125 | no units (0-20) |
| 14 | no units (0-20) |

| Total Habitat | Score | |
|---------------|-------|--|
| Habitat Integ | rity | |

Macroinvertebrate Data - Genus/species Level

- 11. Genus/species Taxa Richness
- 12. Genus/species EPT Richness
- 13. % Ephemeroptera
- 14. % Chironomidae & Oligochaeta
- 15. % Clingers
- 16. mHBI

Macroinvertebrate Bioassessment Conductivity

| | _ |
|-----|--------------------|
| | # of taxa sampled |
| | # of EPT species |
| | sampled |
| | % Mayflies (0-100) |
| | % Midges & |
| | Worms (0-100) |
| | % Clingers (0-100) |
| | no units |
| WA | |
| NA: | no units |
| 500 | microMHOs |



Subindex

0.53

0.10

Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6) Stream/Reach: Pond-106 Assessment Objectives: Immediately after restored Ecological Integrity Index (MBI + Habitat NA Integrity + Conductivity) **Ecological Integrity** Index (Habitat Integrity + 0.38 Conductivity) Units **Variables** Measure Enter quantitative or categorical measure from Field Data Sheet in shaded cells **RBP Habitat Parameters** 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 3. Velocity/Depth Regime no units (0-20) 4. Sediment Deposition no units (0-20) 10 5. Channel Flow Status no units (0-20) 6. Channel Alteration no units (0-20) 20 7. Freq. Of Riffles (bends) no units (0-20) 18 8. Bank stability (both combined) no units (0-20) 12 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20) 150 Total Habitat Score no units Subindex Habitat Integrity 0.67 Macroinvertebrate Data - Genus/species Level 11. Genus/species Taxa Richness # of taxa sampled # of EPT species 12. Genus/species EPT Richness sampled 13. % Ephemeroptera % Mayflies (0-100) % Midges & 14. % Chironomidae & Oligochaeta Worms (0-100)



NA

0.10

% Clingers (0-100)

no units

no units

microMHOs

NA

15. % Clingers

Conductivity

Macroinvertebrate Bioassessment

16. mHBI

| Project ID: Nally & Hamilton (Permit No. 860-0380 |), Am #6) | | |
|--|--|--------------------------|-------------------------------|
| Stream/Reach: HF-16 | | | |
| otrodini vii 10 | | | |
| Assessment Objectives: Immediately after restored | · | | |
| NA . | Ecological Integrity Index (MBI + Habitat | | |
| | Integrity + Conductivity) Ecological Integrity | | 2 (24) 44 (2) (3) (3) (4) (4) |
| 0.30 | Index (Habitat Integrity + Conductivity) | | |
| Variables | Measure | Units | |
| Enter quantitative or categorical measure from Fie | ld Data Sheet in shaded | cells | |
| RBP Habitat Parameters | | | |
| 1. Epifaunal Substrate | 3/17a | no units (0-20) | |
| 2. Embeddedness | 17. 31. | no units (0-20) | |
| 3. Velocity/Depth Regime | 9 | no units (0-20) | |
| 4. Sediment Deposition | 17 | по units (0-20) | |
| 5. Channel Flow Status | 1 | no units (0-20) | |
| 6. Channel Alteration | 15 | no units (0-20) | |
| 7. Freq. Of Riffles (bends) | 20 | no units (0-20) | |
| 8. Bank stability (both combined) | .18 | no units (0-20) | |
| 9. Veg. Protection (both combined) | 12. | no units (0-20) | |
| 10. Riparian Width (both combined) | 14 | no units (0-20) | |
| Total Habitat Score | 140 | no units | Subindex |
| Habitat Integrity | | | 0.50 |
| | | | |
| Macroinvertebrate Data - Genus/species | | | |
| <u>Level</u> | | | |
| 11. Genus/species Taxa Richness | | # of taxa sampled | |
| 12. Genus/species EPT Richness | | # of EPT species sampled | |
| 13. % Ephemeroptera | | % Mayflies (0-100) | |
| 14. % Chironomidae & Oligochaeta | | % Midges & Worms (0-100) | |
| 15. % Clingers | | % Clingers (0-100) | |
| 16. mHBI | | no units | |
| Macroinvertebrate Bioassessment | NA | no:units | ² NA |



Conductivity

Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6) Stream/Reach: Pond-107 Assessment Objectives: Immediately after restored **Ecological Integrity** Index (MBI + Habitat Integrity + Conductivity) NA **Ecological Integrity** Index (Habitat Integrity + 0.38 Conductivity) Variables Units Measure Enter quantitative or categorical measure from Field Data Sheet in shaded cells **RBP Habitat Parameters** 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 3. Velocity/Depth Regime 10 no units (0-20) 4. Sediment Deposition no units (0-20) .9 5. Channel Flow Status no units (0-20) 15 6. Channel Alteration no units (0-20) 20 7. Freq. Of Riffles (bends) no units (0-20) 18 8. Bank stability (both combined) no units (0-20) 12 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20) Subindex Total Habitat Score 149 no units Habitat Integrity 0.65 Macroinvertebrate Data - Genus/species <u>Level</u> 11. Genus/species Taxa Richness # of taxa sampled # of EPT species 12. Genus/species EPT Richness sampled 13. % Ephemeroptera % Mayflies (0-100) % Midges & 14. % Chironomidae & Oligochaeta Worms (0-100) 15. % Clingers % Clingers (0-100) 16. mHBI no units



NA

0.10

no units

microMHOs

Macroinvertebrate Bioassessment

Conductivity

Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6)

Stream/Reach: HF-17

Assessment Objectives: Immediately after restored

| NA | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) | |
|------|---|---|
| 0.30 | Ecological Integrity Index (Habitat Integrity + Conductivity) | · |

Variables Measure Units

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

RBP Habitat Parameters

- 1. Epifaunal Substrate
- 2. Embeddedness
- 3. Velocity/Depth Regime
- 4. Sediment Deposition
- 5. Channel Flow Status
- 6. Channel Alteration
- 7. Freq. Of Riffles (bends)
- 8. Bank stability (both combined)
- 9. Veg. Protection (both combined)
- 10. Riparian Width (both combined)

| er for terroris in the state of the other interests in the contract of the con | a |
|--|-----------------|
| 17 | no units (0-20) |
| 17 | no units (0-20) |
| g | no units (0-20) |
| 17 | no units (0-20) |
| 0.5 | no units (0-20) |
| 15 | no units (0-20) |
| 20 | no units (0-20) |
| 18, | no units (0-20) |
| 12. | no units (0-20) |
| 14 | no units (0-20) |
| | |

| Total Habitat Score | 139 | no units | Subindex |
|--|-----|-------------------|----------|
| Häbitat Integrity | | | 0.49 |
| Macroinvertebrate Data - Genus/species Level | | | |
| 11 Genus/species Tava Richness | | # of taxa campled | |

- 12. Genus/species EPT Richness
- 13. % Ephemeroptera
- 14. % Chironomidae & Oligochaeta
- 15. % Clingers
- 16. mHBI

Macroinvertebrate Bioassessment

Conductivity

| | _ |
|----------------|--------------------------|
| | # of taxa sampled |
| for the second | # of EPT species sampled |
| | % Mayffies (0-100) |
| | % Midges & Worms (0-100) |
| | % Clingers (0-100) |
| | no units |
| NA NA | no units |
| 500 | microMHOs |



NA

0.10

Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6) Stream/Reach: Pond-92 Assessment Objectives: Immediately after restored **Ecological Integrity** Index (MBI + Habitat NA Integrity + Conductivity) **Ecological Integrity** Index (Habitat Integrity + 0.30 Conductivity) **Variables** Measure Units Enter quantitative or categorical measure from Field Data Sheet in shaded cells RBP Habitat Parameters 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 3. Velocity/Depth Regime no units (0-20) 4. Sediment Deposition no units (0-20) 0 5. Channel Flow Status no units (0-20) 6. Channel Alteration no units (0-20) 20 7. Freq. Of Riffles (bends) no units (0-20) 18 8. Bank stability (both combined) no units (0-20) 12 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20) 139 Subindex Total Habitat Score no units Habitat Integrity 0.49 Macroinvertebrate Data - Genus/species <u>Level</u> 11. Genus/species Taxa Richness # of taxa sampled # of EPT species 12. Genus/species EPT Richness sampled 13. % Ephemeroptera % Mayflies (0-100) % Midges & 14. % Chironomidae & Oligochaeta Worms (0-100) 15. % Clingers % Clingers (0-100) 16. mHBI no units NA Macroinvertebrate Bioassessment no units



0.10

microMHOs

Conductivity ...

500

Appendix I

Ell Calculation for 30 Years after Disturbance



Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6)

Stream/Reach: HF-15

Assessment Objectives: 30 Years Post Disturbanc

| | Ecological Integrity Index (MBI + Habitat Integrity + Conductivity) | |
|------|---|--|
| 0.37 | Ecological Integrity Index (Habitat Integrity + Conductivity) | |

Variables Measure Units

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

RBP Habitat Parameters

- 1. Epifaunal Substrate
- 2. Embeddedness
- 3. Velocity/Depth Regime
- 4. Sediment Deposition
- 5. Channel Flow Status
- 6. Channel Alteration
- 7. Freq. Of Riffles (bends)
- 8. Bank stability (both combined)
- 9. Veg. Protection (both combined)
- 10. Riparian Width (both combined)

| 17. | no units (0-20) |
|------|-----------------|
| 17 | no units (0-20) |
| 10 | no units (0-20) |
| 17 | no units (0-20) |
| 2 | no units (0-20) |
| 15 | no units (0-20) |
| - 20 | no units (0-20) |
| 18 🚁 | no units (0-20) |
| 14 | no units (0-20) |
| 18 | no units (0-20) |

| Total Habitat Score | 148 no units | Subin |
|--|--------------|-------|
| Habitat Integrity | | 0.6 |
| Macroinvertebrate Data - Genus/species Level | | |

- 11. Genus/species Taxa Richness
- 12. Genus/species EPT Richness
- 13. % Ephemeroptera
- 14. % Chironomidae & Oligochaeta
- 15. % Clingers
- 16. mHBI

Macroinvertebrate Bioassessment Conductivity

| | # of taxa sampled | |
|--------|----------------------------------|---------|
| | # of EPT species sampled | |
| | % Mayflies (0-100) % Midges & | |
| 10 200 | Worms (0-100) | See See |
| | % Clingers (0-100) | |
| NA | no units no units | NA |
| - NA | TIO GIRES | 646 |



| Project ID: Nally & Hamilton (Permit No. 860-0380 |), Am #6) | | |
|--|--|-----------------------------|----------|
| Stream/Reach: Pond-106 | | | |
| one roo | | | |
| Assessment Objectives: 30 Years Post Disturbanc | | | |
| | Ecological Integrity | | |
| NA | Index (MBI + Habitat Integrity + Conductivity) | | |
| | Ecological Integrity Index (Habitat Integrity + | | 1 1 |
| 0.43 | Conductivity) | | |
| Variables | Measure | Units | e. |
| Enter quantitative or categorical measure from Fie | eld Data Sheet in shaded | cells | |
| RBP Habitat Parameters | | | |
| 1. Epifaunal Substrate | £417 | no units (0-20) | |
| 2. Embeddedness | 17, | no units (0-20) | |
| 3. Velocity/Depth Regime | 10 | no units (0-20) | |
| 4. Sediment Deposition | 17. | no units (0-20) | |
| 5. Channel Flow Status | 10 | no units (0-20) | |
| 6. Channel Alteration | 15 | no units (0-20) | |
| 7. Freq. Of Riffles (bends) | 20, | no units (0-20) | |
| 8. Bank stability (both combined) | 18 | no units (0-20) | |
| 9. Veg. Protection (both combined) | 14 14 | no units (0-20) | |
| 10. Riparian Width (both combined) | 18 | no units (0-20) | |
| Total Habitat Score | 156 | no units | Subindex |
| Habitat Integrity | | | 0.77 |
| Macroinvertebrate Data - Genus/species | | | |
| Level | • | | |
| 4 | | | |
| 11. Genus/species Taxa Richness | | # of taxa sampled | |
| 12. Genus/species EPT Richness | | # of EPT species sampled | |
| 13. % Ephemeroptera | | % Mayflies (0-100) | |
| 14. % Chironomidae & Oligochaeta | | % Midges & Worms (0-100) | |
| 15. % Clingers | The state of the s | % Clingers (0-100) | |
| 16. mHBI | | no units | |
| Macroinvertebrate Bioassessment | 6 a - 35 a 6 a 6 a 6 a 6 a 6 a 6 a 6 a 6 a 6 a | no units | NA |



Conductivity

Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6) Stream/Reach: HF-16 Assessment Objectives: 30 Years Post Disturbanc **Ecological Integrity** Index (MBI + Habitat NA Integrity + Conductivity) **Ecological Integrity** Index (Habitat Integrity + 0.35 Conductivity) **Variables** Measure Units Enter quantitative or categorical measure from Field Data Sheet in shaded cells RBP Habitat Parameters 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 3. Velocity/Depth Regime no units (0-20) no units (0-20) 4. Sediment Deposition 5. Channel Flow Status no units (0-20) 6. Channel Alteration no units (0-20) 7. Freq. Of Riffles (bends) no units (0-20) 8. Bank stability (both combined) no units (0-20) 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20) 146 Subindex Total Habitat Score no units Habitat Integrity .60 Macroinvertebrate Data - Genus/species <u>Level</u> 11. Genus/species Taxa Richness # of taxa sampled # of EPT species 12. Genus/species EPT Richness sampled 13. % Ephemeroptera % Mayflies (0-100) % Midges & 14. % Chironomidae & Oligochaeta Worms (0-100) 15. % Clingers % Clingers (0-100) 16. mHBI no units Macroinvertebrate Bioassessment no units



0.10

microMHOs

500

Conductivity

Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6) Stream/Reach: Pond-107 Assessment Objectives: 30 Years Post Disturbanc **Ecological Integrity** Index (MBI + Habitat NA Integrity + Conductivity) **Ecological Integrity** Index (Habitat Integrity + 0.43

Conductivity)

9

15

20

18

14

18

Variables Measure Units

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

RBP Habitat Parameters

- 1. Epifaunal Substrate
- 2. Embeddedness
- 3. Velocity/Depth Regime
- 4. Sediment Deposition
- 5. Channel Flow Status
- 6. Channel Alteration
- 7. Freq. Of Riffles (bends)
- 8. Bank stability (both combined)
- 9. Veg. Protection (both combined)
- 10. Riparian Width (both combined)

| Total Habitat Score | 155 | no units |
|---------------------|-----|----------|

Habitat Integrity

Macroinvertebrate Data - Genus/species <u>Level</u>

- 11. Genus/species Taxa Richness
- 12. Genus/species EPT Richness
- 13. % Ephemeroptera
- 14. % Chironomidae & Oligochaeta
- 15. % Clingers
- 16. mHBI

Macroinvertebrate Bioassessment

Conductivity

| | _ | 200 |
|------|--------------------------|-------|
| | # of taxa sampled | |
| | # of EPT species sampled | |
| | % Mayflies (0-100) | |
| | % Midges & Worms (0-100) | |
| | % Clingers (0-100) | |
| | no units | |
| NA | no units | NA NA |
| 500% | microMHOs | 0.10 |



no units (0-20)

Subindex

Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6)

Stream/Reach: HF-17

Assessment Objectives: 30 Years Post Disturbanc

| | L Ecological Illedition | Para de la companya | |
|------|-----------------------------|--|---------------------------------|
| N/A | Index (MBI + Habitat | | |
| NA | Integrity + Conductivity) | Contract Con | \$ \$40 \displays 1.0 \displays |
| | Ecological Integrity | | |
| | Index (Habitat Integrity + | | [[|
| 0.34 | Conductivity) | | |

Variables

Measure

Units

Enter quantitative or categorical measure from Field Data Sheet in shaded cells

RBP Habitat Parameters

- 1. Epifaunal Substrate
- 2. Embeddedness
- 3. Velocity/Depth Regime
- 4. Sediment Deposition
- 5. Channel Flow Status
- 6. Channel Alteration
- 7. Freq. Of Riffles (bends)
- 8. Bank stability (both combined)
- 9. Veg. Protection (both combined)
- 10. Riparian Width (both combined)

| 2717 | no units (0-20) |
|------|-----------------|
| 17 | no units (0-20) |
| 9, | no units (0-20) |
| 17 | no units (0-20) |
| 0 | no units (0-20) |
| 15. | no units (0-20) |
| 20 | no units (0-20) |
| 18 | no units (0-20) |
| 14** | no units (0-20) |
| 18 🛬 | no units (0-20) |

Total Habitat Score

145 no units

Subindex

0.58

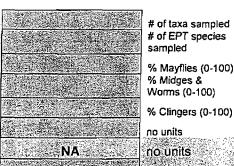
Habitat Integrity

Macroinvertebrate Data - Genus/species Level

- 11. Genus/species Taxa Richness
- 12. Genus/species EPT Richness
- 13. % Ephemeroptera
- 14. % Chironomidae & Oligochaeta
- 15. % Clingers
- 16. mHBI

Macroinvertebrate Bioassessment

Conductivity

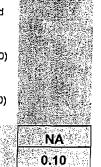


of EPT species

Worms (0-100)

% Clingers (0-100)

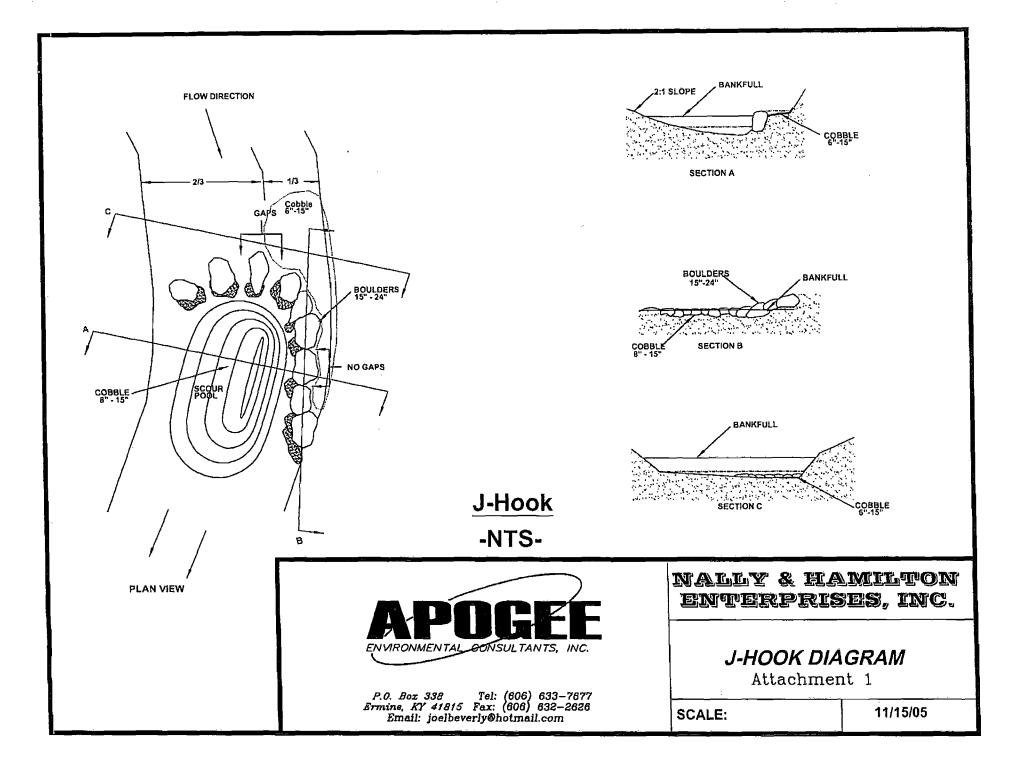
microMHOs

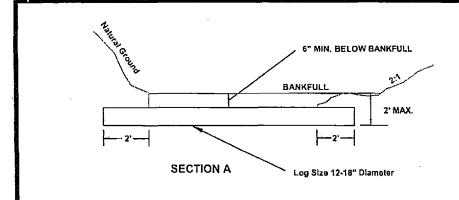


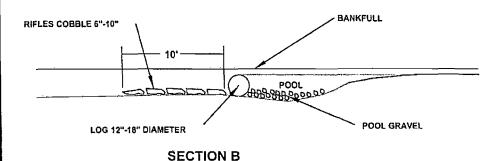


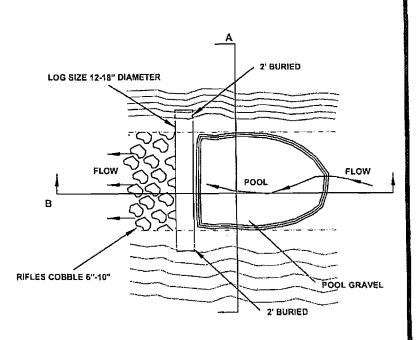
Project ID: Nally & Hamilton (Permit No. 860-0380, Am #6) Stream/Reach: Pond-92 Assessment Objectives: 30 Years Post Disturbanc **Ecological Integrity** Index (MBI + Habitat NA Integrity + Conductivity) **Ecological Integrity** Index (Habitat Integrity + 0.34 Conductivity) **Variables** Measure Units Enter quantitative or categorical measure from Field Data Sheet in shaded cells **RBP Habitat Parameters** 1. Epifaunal Substrate no units (0-20) 2. Embeddedness no units (0-20) 9 3. Velocity/Depth Regime no units (0-20) 4. Sediment Deposition no units (0-20) 5. Channel Flow Status no units (0-20) 6. Channel Alteration no units (0-20) 20 7. Freq. Of Riffles (bends) no units (0-20) 8. Bank stability (both combined) no units (0-20) 9. Veg. Protection (both combined) no units (0-20) 10. Riparian Width (both combined) no units (0-20) Subindex Total Habitat Score no units 0.58 Habitat Integrity Macroinvertebrate Data - Genus/species <u>Level</u> 11. Genus/species Taxa Richness # of taxa sampled # of EPT species 12. Genus/species EPT Richness sampled 13. % Ephemeroptera % Mayflies (0-100) % Midges & 14, % Chironomidae & Oligochaeta Worms (0-100) 15. % Clingers % Clingers (0-100) 16. mHBI no units Macroinvertebrate Bloassessment no units NA Conductivity microMHOs 0.10











Log Vane
-NTS-



P.O. Box 338 Tel: (606) 633-7677

Ermins, KY 41815 Fax: (606) 632-2626

Email: joelbeverly@hotmail.com

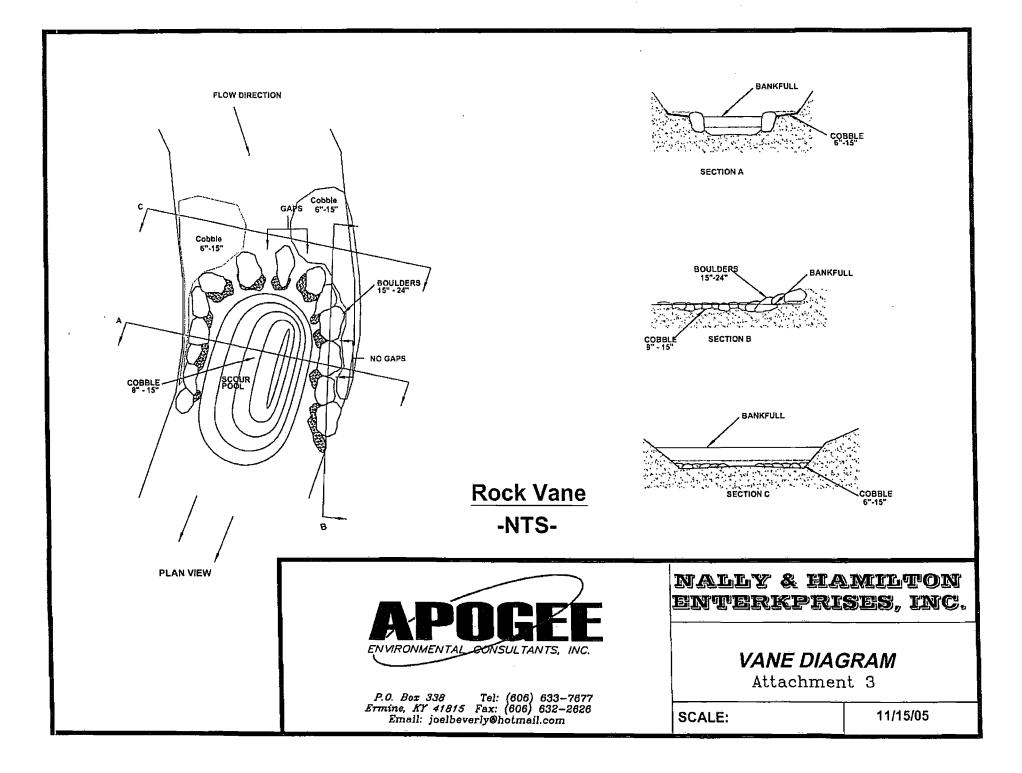
nally & Hamilton Enterprises, inc.

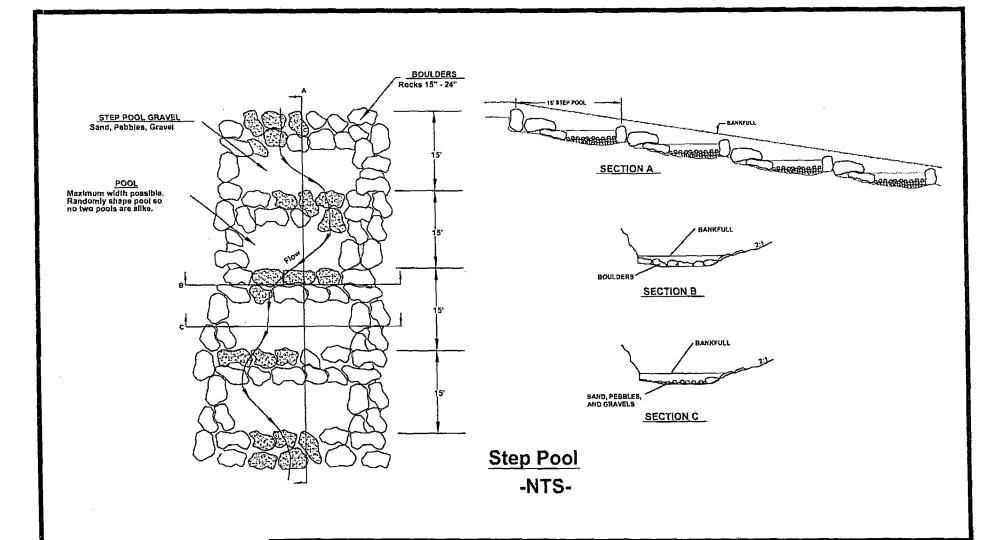
VANE DIAGRAM

Attachment 2

SCALE:

11/15/05







P.O. Box 338 Tel: (606) 633-7677

Ermine, RY 41815 Fax: (606) 632-2628

Email: joelbeverly@hotmail.com

nally & Hamilton Enterprises, inc.

STEP POOL DIAGRAM

Attachment 4

SCALE:

11/15/05



Longitudinal Profile Data Sheet -POND 107-A5

| Project # | Proje | ct Name <u>86</u> | 0-0390 | Norh ! | ⁴ 5 |
|-----------------|---------|------------------------|---------|----------|----------------|
| Stream/Drainage | SULAR | BRANCH | | Date | 11-10-05 |
| GPS: N 37° 14' | 01.1" | w _ | 83°01'3 | 32.3" | |
| County KNOFT | State _ | <u></u> K y Qua | d BLACK | <u> </u> | |

| from Beg(ft) (ft) Characteristic (Tenths) (ft) 1 0 £9.0 £ £ £ £ £ DRY 2 £ £ £ 6 £ £ £ £ £ \$ 3 22.02 90.4 £ £ £ £ £ \$ 4 31.51 90.9 £ £ £ £ £ £ \$ 5 37.86 30.7 Pcci \$ 6 43.96 91.6 Pcci \$ | ankfull enths) '/ |
|--|-------------------------|
| 1 0 89.0 RIFFLE DRY 2 8.86 89.6 RIFFLE 1 3 22.02 90.4 RIFFLE 4 31.51 90.9 RIFFLE 5 37.86 30.7 Pool 6 43.96 91.6 Pool | |
| 2 6.86 89.6 REFILE 3 22.02 90.4 RIFFLE 4 31.51 90.9 RIFFLE 5 37.86 30.7 Pool 6 43.96 91.6 Pool 6 | 4 |
| 2 6.86 89.6 REFILE 3 22.02 90.4 RIFFLE 4 31.51 90.9 RIFFLE 5 37.86 30.7 Pool 6 43.96 91.6 Pool 6 | |
| 4 31,51 90,9 RIFFLE 5 37,86 30.7 Pool 6 43.96 91,6 Pool 6 | |
| 5 37,86 30.7 Pool 6 | |
| 6 43.96 91.6 PERL 6 | |
| 6 43.96 91.6 800 6 | |
| | · |
| 7 46.58 91.8 POOL | |
| 8 53,17 22.7 REFFLE | |
| 9 69.37 93.3 RIFFLE 10 87.47 93.9 REFFLE | |
| 10 87,47 93.9 REFFLE | |
| 11 101.76 94,8 RIFFLE | |
| 12 128.56 96.7 REFFLE | |
| 13 149.91 97.3 KLITLE | |
| 14 159,17 98.3 REFFLE DRY | |
| 15 | |
| 16 | |
| 17 | |
| 18 | |
| 19 | |
| 20 | |
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| 22 | |
| 23 | |
| 24 | |
| 25 | |
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| 27 | |
| 28 | |
| 29 | |
| 30 | |



Longitudinal Profile Data Sheet HOLLOWFICE 16-A5

| Project # | Project Name | 860-0380 | ADm | P5 |
|-----------------|--------------|------------|------|----------|
| Stream/Drainage | SUGAR BRAN | -C.H | Date | 11-10-05 |
| GPS: N 37° 14 | 01,1" | W 83°01'32 | .3" | |
| County KADET | State Ky | Quad BLACK | εy | |

| Point | Distance | Elevation | Stream | Water depth | Bankfull |
|-------|--------------|-----------|----------------|-------------|----------|
| | from Beg(ft) | (ft) | Characteristic | | (Tenths) |
| 1 | 0 | 98.3 | RIFFLE | DAY | |
| 2 | 20.68 | 99.2 | RIFFLE | 4 | |
| 3 | 43,00 | 100.1 | Pool | | |
| 4 | 67.64 | 101.4 | POO C | ď. | 3 |
| 5 | 70,24 | 103,3 | R LFFLE | ORY 2" | |
| 6 | <i>93.16</i> | 104.8 | PeaL REFFIE | 211 | |
| 7 | 97.74 | 109.1 | REFFLE | DRY | |
| 8 | 110.20 | 105.6 | RLFFIF | 4 | |
| 9 | 124.54 | 110.3 | RIFFLE | | |
| 10 | 142,44 | 113.6 | RIFFLE | V | |
| 11 | 162,02 | 119.8 | RITTLE | DRY | |
| 12 | 178.04 | 120.0 | RIFFICE | SHEET FLOW | |
| 13 | 199,90 | 124.3 | PCOL | 3" | 6 |
| 14 | 209,88 | 124.7 | REFFLE | SHEET FLAW | |
| 15 | 212.20 | 126.3 | RIFFLE | SHEET FLOW | : |
| 16 | 270.57 | 127.8 | RIFFLE | SHEEF FLOW | |
| 17 | | | | | |
| 18 | | | | | |
| 19 | | | | , | |
| 20 | | | | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | | | | | |
| 24 | | | | • | <u>·</u> |
| 25 | | | | | |
| 26 | | | | | |
| 27 | | | | | |
| 28 | | | | | |
| 29 | | | | | |
| 30 | | | · | | |



Cross Section Data Sheet - POND 107-AS

| Projec | t# | Project N | lame 860-0380 Hom #5 |
|---------------|--------------------------|-------------------|----------------------|
| Stream | n/Drainage <u>5</u> | ULAR B | RANCH Date 11-10-05 |
| GPS: N | N 37°14'0 | 21.1" | W 83°01'32,3" |
| County | KNORT | State K | V Quad BCACKEN |
| | | | Quad $BCACKEI/$ |
| Point | Distance from LB (ft) | Elevation (ft) | Description |
| 1 | 0 | 38.0 | HILL |
| 2 | 5.73 | 96,7 | TOP OF BANK |
| _ 3 | 6,92 | 94,7 | CHENNEL |
| <u>4</u> 5 | 11,12 | 1 54.7 | (HANNEL. |
| | 12,39 | 95,2 95,3 | BANKFUL |
| 6 | 15.07 | 95,3 | BOTTOM OF BANK |
| 7 | 20.99 | 57,7 | top OF BANK |
| 8 | 31.43 | 98.3 | HICC |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |



Cross Section Data Sheet -HOLLOWFILL 16-AS

| Projec | † # | Project N | Name 860-0380 AOm #5 |
|--------|--------------|---------------------------------------|----------------------|
| Stream | n/Drainage / | 1.0ject. | RANCH Date 11-10-05 |
| otrean | indianage | VEAN B | Date 11 10 00 |
| GPS: N | 3701410 | 4./" | W 83°0('32.3" |
| County | 1 KNOFT | _ State <u> /</u> < | Quad BLACKEY |
| Featur | e Surveyed | X riffle | e pool |
| Point | Distance | Elevation | Description |
| | from LB (ft) | (ft) | Description |
| 1 | 0 | | |
| 2 | 6.39 | | Ferron BANK |
| 3 | 10,54 | 106.1 | TOP OF BANK |
| 4 | 11.86 | 104.3 | CHANNEL |
| 5 | 17.72 | 103.4 | THALWEL |
| 6 | 19.75 | 103,8 | CHANNEL |
| 7 | 20.94 | 104.8 | BANKFUL |
| 8 | 22.97 | 106.2 | TOPOF BANK |
| 9 | 29,33 | 109.7 | HILL |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | , |
| 23 | | | |
| 04 | | · · · · · · · · · · · · · · · · · · · | , |

25

02/28/2005 15:54

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CELRL OP CARR CREEK

PAGE

| Stream Channel Classification (Level II) |
|---|
| Stream NAME: VINGGEO TREE TO BREETENE (AEEK |
| Basin NAME: Hollow Fill 17-AA Drainage AREA: 27.3 acre mi ² Locations |
| Twp: Rge: See: Qtr. Lat: Long: |
| Bankfull WIDTH (Wbkt) WIDTH of the stream channel, at bankfull stage elevation, in a tiffle section. |
| Mean DEPTH (doid) (), 25 Feet Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section. (dur-Aurway) |
| Bankfull Cross Section Area (Abk) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section. |
| WIDTH / DEPTH RATIO (What / distributed) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section. |
| Maximum DEPTH (d _{mbkt}) O. 3 4 Feet Maximum depth of the bankfull channel cross-section, or distance between the bankfull singe and thalway elevations, in a riffle section. |
| WIDTH of Flood-Prone Area (W _{floa}) Twice maximum DEPTH, or (2 x d _{mbd.}) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section. |
| Entrenchment Ratio (ER) [1, 3] FUFt The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH. (W _{fr} /W _{bl.}) (riffle section) |
| Channel Materials (Particle Size Index) D50 mm The D50 particle size index represents the mean diameter of channel materials, as sampled from the channel surface, between the bankfull stage and thalwag elevations. |
| Water Surface SLOPE. (S) Channel slope = "rise over run" for a reach approximately 20 - 30 bankfull channel widths in length, with the "niffle to riffle" water surface slope representing the gradient at bankfull stage. |
| Channel SINUOSITY (K) Simuosity is an index of channel pattern, dotermined from a ratio of stream length divided by valley length (SI/VL); or estimated from a ratio of valley slope divided by channel slope (VS/S). |
| Stream Type For Robinstones, 800 page 5-5, 6-8: Rosgan, 1998. Applied Fover Morphology, |

B17.



Pebble Count Data Sheet - Hollow FELL 17-86

| Project # | Project Nam | ne AUUH | ADA | 7 6 | |
|-----------------|-------------------|----------|-----|------|---------|
| Stream/Drainage | VUNLARO TRED ! | BREEDZAL | CK. | Date | 1-11-06 |
| GPS: N | | w | | | |
| County K.vorT | State <u>K //</u> | Quad | | | |

| Point | Pebble | | Point | Pebble | 1.3 | Point | · Pebble | | Point | Pebble |
|-------|-------------|-------|-------|-------------|---------|-------|---------------------|---------|-------|-------------------------------|
| (m) | _size.(mm) | | (m) | size (mm) | | 1 2 | size (mm): | 1 | | Contract to the second second |
| 0 | <i>j</i> 2 | | 26 | SANO | | 52 | | 1 | 78 | |
| 1 | 2.5 | N. | 27 | 9 | 2.1 | 53 | | | 79 | |
| 2 | 165 | | 28 | 250 | | 54 | | | 80 | |
| 3 | ن ئې ئې | | 29 | 30 | 1 | 55 | 1 | | 81 | |
| 4 | 225 | | 30 | Ty Cy | | 56 | | | 82 | |
| 5 | 134 | | 31 | 2 <i>55</i> | | 57 | | | 83 | |
| 6 | 42 16AL | | 32 | 435 | * | 58 | | | 84 | |
| 7 | 32 COAL | | 33 | 95 | j., v | 59 | | | 85 | |
| 8 | <u> </u> | | 34 | 120 | | 60 | | | 86 | |
| 9 | 10 | | 35 | .2 € | | 61 | | | 87 | |
| 10 | 47 7 | | 36 | 135 | | 62 | | | 88 | |
| 11 | 66 73 | · | 37 | 19 | | 63 | 7 | 43.5 | 89 | |
| 12 | 7.3 | | 38 | 22 | | 64 | | 0 | 90 | |
| 13 | 55 | | 39 | 186 | n 1 - 5 | 65 | | | 91 | |
| 14 | /1 | \$1 | 40 | 55 | | 66 | 7.2 | | 92 | |
| 15 | 27 6546 | | 41 | 77 | | 67 | | | 93 | |
| 16 | 21 | 7 | 42 | 170 | | 68 | | | 94 | |
| 17 | 7,5 | | 43 | 160 | | 69 | | | 95_ | |
| 18 | 26 | | 44 | 170 | | 70 | 3 | | 96 | |
| 19 | <i>j.</i> 7 | | 45 | 19 | | 71 | | | 97 | |
| 20 | P1 | | 46 | 102 | | 72 | | y Ma | 98 | |
| 21 | 16 |) | | F6 | | 73 | | ČŽ. | 99 | |
| 22 | 122 | | | 157 | . 7 | 74 | | | 100 | |
| 23 | : 6 | | 49 | 170 | | 75 |]. 2 24 24 | | | |
| 24 | £C | | 50 | 47 | | 76 | (A) | | | |
| 25 | | | 51 | ୧୬ | | 77 | « * | ٠ ن | | |



Longitudinal Profile Data Sheet - Hollow Fill 17-AE

| Project # <u>05-104.00</u> Project Name | NOH POMG |
|---|--------------------------|
| Stream/Drainage UNNAMED TAIL | BAEEN ENGLK Date 1-11-66 |
| GPS: N 37°14'40,9" | W 83°01'58,5" |
| County KNOFT State KV | Quad Blackey |

| Point | Distance | Elevation | Stream | Water depth | Bankfull |
|-------|--------------|--------------|----------------|---|----------|
| | from Beg(ft) | (ft) | Characteristic | 11 (a) 3.5 (1.5 (a) 1.6 (b) 2.5 (b) 2.5 (c) 2.5 (c) 2.7 (c) | |
| 1 | _ 0 | 22,6 | RIFFLE | DRY | |
| 2 | 3. / | 92,6 23,6 | REFFIE | A | |
| 3 | 17,7 | 85,4 | RIFFLE | | |
| 4 | 22, 8 | 82.4 | REFFLE | | |
| 5 | 29,5 | 88.4 | RIFFIE | | |
| 6 | 31.0 35.5 | 35. 4 | REFFCE | | 371 |
| 7 | 35. <u>8</u> | 91.3 | REFFECT | | |
| 8 | 38, 3 | 21.3 | 1 fee 6 | | |
| 9 | 42,4 | 23.8 | REFELE | | |
| 10 | 64.3 71.0 | 32,5 | RIFFLE | | |
| 11 | 71,0 | 166, 2 | REFFLE | | |
| 12 | 23, E | 102.0 | R LFFLE | | |
| 13 | 97.2 | 105,4 | RIFFLE | | |
| 14 | 102,1 | 166.1 | RIFFLE | | |
| 15 | 104,1 | 107,0 | REFFLE | | |
| 16 | 105.6 | 107.1 | Pool | | |
| 17 | 100,0 | 127,4 | KIFFELG | | |
| 18 | 112,7 | (D) (S) | R E FP(G | | |
| 19 | 177,1 | (11,E | KEFFLE | | |
| 20 | 131.2 | 113.7 | RAFFICE | | |
| 21 | 135,9 | 116.4 | RIFFLE | | |
| 22 | 140,6 | 117,0 | RIFFLE | | |
| 23 | 143,1 | 116.7 | Pool | 3 | 3/ |
| 24 | 145.3 | 118,3 | REPFLE | | |
| 25 | 157,5 | 120.5 | REFFLE | | |
| 26 | 159,6 | (20,3 | Post | | |
| 27 | 168,6 | 124.4 | RIFFLE | | |
| 28 | 175.3 | | REFFLE | | |
| 29 | 177,0 | | Fool | ý | |
| 30 | 187.1 | 127.5 | RIFFLE | DRY | |



Hollow Fill 17-Alo cont...

| Point | Distance | Elevation | Stream | Water depth | Bankfull |
|-------|--------------|-----------|-------------------|-------------|----------|
| | from Beg(ft) | (ft) | Characteristic | (Tenths) | (Tenths) |
| 31 | 214,3 | 135,2 | RIFFLE | PRY | |
| 32 | 227.8 | 132.4 | R I FELE | ^ | |
| 33 | 234.7 | 1460 | R BEFLE | | |
| 34 | 244,1 | 173.7 | REFFLE |) | |
| 35 | 276.1 | 143.3 | Pool | | |
| 36 | 262,0 | 151.2 | RIFFLE | 1 | |
| 37 | 270,7 | 153.7 | P DEFLE | j | ···· |
| 38 | 285,4 | 1635 | R EFFLE REFFLE | V | |
| 39 | 294, O | 164,2 | RIFFLE | BRU | |
| 40 | | | | / | |
| 41 | | | | | |
| 42 | | | | | |
| 43 | | | | | |
| 44 | | | | | |
| 45 | | | | | |
| 46 | | | | | |
| 47 | | | | | |
| 48 | | | | | |
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| 50 | | | | | |
| 51 | | | | | |
| 52 | • | | | | |
| 53 | | | | | |
| 54 | | | | | |
| 55 | | | | | |
| 56 | | | | | |
| 57 | | | | | |
| 58 | | | | | |
| 59 | | | | | |
| 60 | | | | | |



Cross Section Data Sheet-Hollow FTL 17-A6

| Project # <u>05 - 104.0</u> | Project Name | NOH HOM. 6 |
|-----------------------------|--------------|--------------------------|
| Stream/Drainage Value | LANED THIS | BREEDERY CK Date 1-11-06 |
| GPS: N <u>37°14'4</u> | 0.3" | W 83°01'58,5" |
| County Kroti | State KV | Quad Blackey |
| Feature Surveyed | riffle | ⊠ pool |

| | • | استج | |
|----------|---------------------------------------|-----------|-------------------------|
| Point | # # # # # # # # # # # # # # # # # # # | Elevation | Description |
| <u> </u> | from LB (ft) | (ft) | |
| 1 | 0 | 119.7 | ASCC |
| 2 | 1.9 | 117,4 | TOP EFBANK |
| 3 | 3,4 | 117.0 | FACK FUL |
| 4 | 4,8 | 116.8 | THALWEL |
| 5 | 3,4 4,8 5,7 | 116,9 | PARKFUL THALWEL CHANNEL |
| 6 | 7,4 | 112,2 | していき むた 一倍 巻 ルド |
| 7 | 19, 7 | 113.6 | TOP FF BALK |
| 8 | 24,1 | 117.0 | TOP IF BANK THACWEG |
| 9 | 29 <u>, J</u> | 120.7 | HILL |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | _ | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | - | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| | | | |



Cross Section Data Sheet - Hollow FILL 17 -AE

| Projec | t# 05-104.01 | O Project N | Name <u>N&H ADM 6</u> | | | | | |
|-------------------|----------------------------------|-------------|-----------------------------|--|--|--|--|--|
| St≝ean | n/Drainage 🌃 | 83MED 78 | 46 BECORDAY (K Date 1-11-66 | | | | | |
| GFS: N | GFS: N 37°14'40.5" W 83°01'58.5" | | | | | | | |
| | | | W Quad Blackey | | | | | |
| Featur | e Surveyed | riffle | pool | | | | | |
| Point | | | Description | | | | | |
| -1 | 0 | 109.0 | HILL | | | | | |
| 2 | 5, 2 | 100,7 | BANKFUL | | | | | |
| | €.4 | 105.8 | THALWEL | | | | | |
| | 7,3 | 1055 | CHANNEL | | | | | |
| 5 | 9.8 | 105,8 | top of HANK | | | | | |
| 3 | 11.8 | 107.1 | TOP OF BAUK | | | | | |
| 7 3 | 24.7 | 107,3 | CHANDEL | | | | | |
| 3 | 23, / | 106.5 | BATTOM OF BANK/ (HON-EL | | | | | |
| -i | 25.8 | 107.0 | TOP OF BANK | | | | | |
| 10 | 29,2 | 109.1 | 1/20 L | | | | | |
| -1 | | | | | | | | |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 15 | | | | | | | | |
| 17 | | | | | | | | |
| 18 | | | | | | | | |
| 19 | | | | | | | | |
| 20 | | | | | | | | |
| 21 | | | | | | | | |
| ~ ~ ~ | | | | | | | | |

23 24 25

| Stream Channel Classification (Level II) |
|--|
| Stream NAME: VANAMED TRIB TO DEFENTED CREEK |
| Basin NAME: Por 92-A6 Drainage AREA: 51.6 acre mi ² |
| Locations K. Witt Cov-Til |
| Twp: Rge: Sca: Qtr Lat: Long: |
| Observers: Date: |
| |
| Bankfull WIDTH (Wold) |
| WIDTH of the stream channel, at bankfull stage elevation, in a riffle section. |
| |
| |
| |
| Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section. |
| |
| Bankfull Cross Section Area (Abb) |
| AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section. |
| |
| |
| WIDTH / DEPTH RATIO (What /dold). |
| Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section. |
| |
| |
| Maximum DEPTH (diabki) 0,36 Feet |
| Maximum depth of the bankfull channel cross-section, or distance between the bankfull singe and |
| thatweg elevations, in a riffle section. |
| WIDTH of Flood-Prone Area (W _{free}) |
| Twice maximum DEPTH, or $(2 \times d_{\text{max}})$ = the stage/elevation at which flood-prone area WIDTH is |
| determined in a riffle section. |
| |
| Entrendament Ratio (ER) |
| The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (Wips/Wold) (riffle |
| section) |
| |
| Channel Materials (Particle Size Index) D50mm |
| The D50 particle size index represents the mean diameter of channel materials, as sampled from the |
| channel surface, between the bankfull stage and thalweg elevations. |
| |
| Water Surface SLOPE (S) |
| Channel slope = "rise over run" for a reach approximately 20 - 30 bankfull channel widths in length, |
| with the "riffle to riffle" water surface slope representing the gradient at bankfull stage. |
| |
| Channel SINUOSITY (K) Sinuosity is an index of channel pattern, determined from a ratio of stream length divided by valley |
| length (SLIVL); or estimated from a ratio of valley slope divided by channel slope (VS/S). |
| rength (512 v L), or estimated from a radio of vaniey stope divided by Commercial (v L J). |
| Stroam Type |
| Stream Type Rosgen, 1996. Applied River Morphology. |



Pebble Count Data Sheet

| Project# | Project Name | Lick Branch | |
|-----------------|------------------|---------------|--|
| Stream/Drainage | Lick Fork Middle | Fork KY Date | |
| GPS: N | W | | |
| County Leslie | State KY Qu | ad Hoskinston | |

| Cou | nty Les in | ۲_ | St | State Ki | | e Ki Quad Hoskinston | | | | |
|-------|---------------|-------|-------|-------------|-----|----------------------|-------------|--------------|-------|-----------|
| Point | 北 コー・インタイプ おり | ````` | Point | Pebble | · . | Point | Pebble | 17 | Point | Pebble |
| (m)- | size (mm |) | | sîze (mm) | | (m) | size (mm |) [7. | (m) | size (mm) |
| 0 | 15:H | R | | Sand | R | 60 | 3 45 | F | 90 | 27 |
| . 1 | 5:1+ | 2 | 31 | 28 | R | 61 | 87 | R | 91 | 25 |
| 2 | 5:1+ | R | 32 | sand | 8 | 62 | 133 | P | 92 | Sand |
| 3 | 18 | P | 33 | 16 | K | 63 | Sand | P | 93 | 300 |
| 4 | 20 | P | 34 | 68 | R | 64 | 35 | R | 94 | 80 |
| 5 | 6 | P | 35 | 16 | R | 65 | 9 | K | 95 | 37 |
| 6 | Soud | P | 36 | 5 | P | 66 | 50 | R | 96 | 20 |
| 7 | 12 | P | 37 | 75 | P | 67 | 100 | P | 97 | 69 |
| 8 | 510 | P | 38 | 20 | 13 | 68 | 120 | R | 98 | 40 |
| 9 | 118 | P | 39 | 107 | K | 69 | | R | 99 | 27 |
| 10 | 14 | R | 40 | 115 | R | 70 | 32 | K | 100 | 26 |
| 11 | 10 | K | 41 | 24 | K | 71 | 95 | R | 101 | |
| 12 | Sand | 2 | 42 | 4 | P | 72 | 890 | R | 102 | |
| 13 | 40 | R | 43 | 45 | R | 73 | 120 | R | 103 | |
| 14 | Sand | R | 44 | 27 | K | 74 | 32 | R | 104 | |
| 15 | Sand | R | 45 | 23 | K | 75 | 90 | R | 105 | |
| 16 | 25 | R | 46 | 25 | K | 76 | 92 | R | 106 | |
| 17 | 7 | 8 | 47 | 70 | R | 77 | 50 | K | 107 | |
| 18 | Sand | P | 48 | | R | 78 | 28 | R | 108 | |
| 19 | Sund | P | 49 | 300 | R | 79 | <u>sand</u> | P | 109 | |
| 20 | 28 | R | 50 | 15 | R | 80 | 1200 | R | 110 | |
| 21 | 5 | R | 51 | | F | 81 | 75 | R | 111 | |
| 22 | | K | 52 | | P | 82 | 72 | R | 112 | |
| 23 | 2-3 | R | 53 | | 8 | 83 | 30 | P | 113 | |
| 24 | 18 | 72 | 54 | | 8 | 84 | | R | 114 | |
| 25 | | R | 55 | | R | 85 | | P | 115 | |
| 26 | | R. | 56 | 20 1 | R | 86 | | R | 116 | |
| 27 | 35 | R | 57 | | 2 | 87 | | K | 117 | |
| 28 | | R | 58 | | 3 | 88 | | سننذ | 118 | |
| 29 | 70 | R | 59 | 7 | ? | 89 | 77 | R | 119 | |

Annaee Environmental Consultant

100 100 6.71% 2.717% 50 50 2+50 1+00 1+50 2+00 0+00 0+50 **Profile** 207' ection Stream Length 227' Cross : Cross Sinuosity & HAMILTON Typical longitudinal profile of five to seven percent sloped stream, NVIRONMENTAL CONSULTANTS, INC.



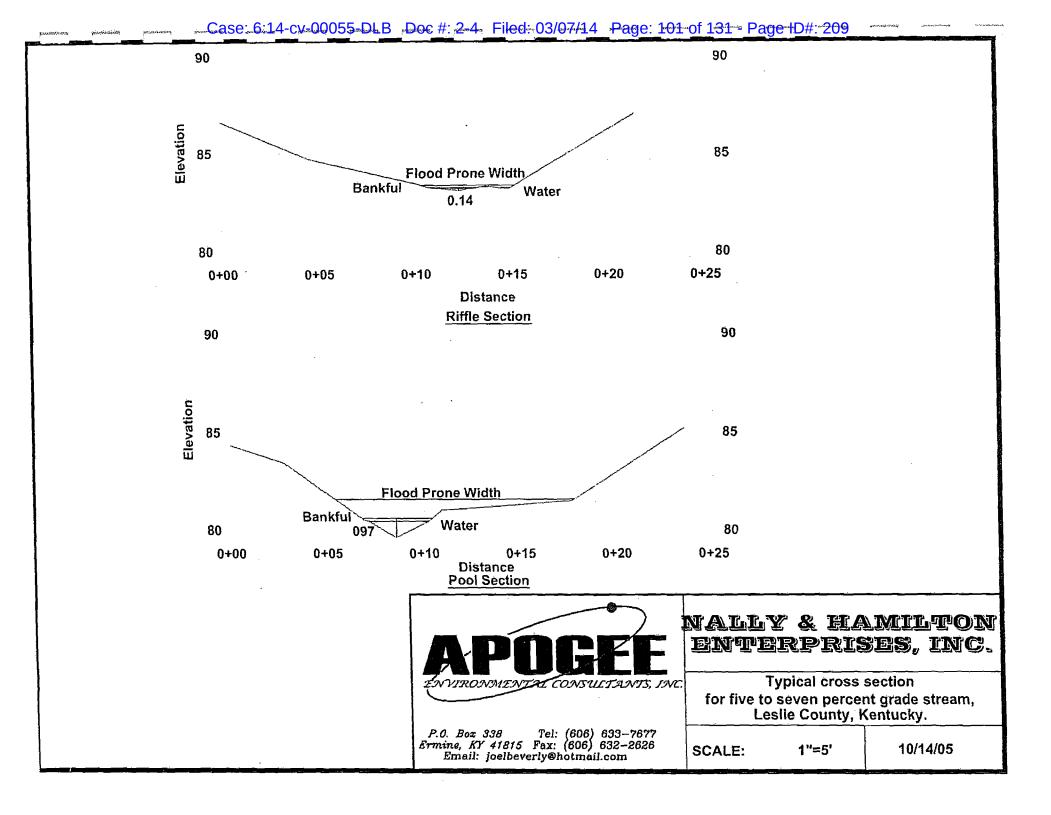
P.O. Box 338 Tel: (606) 633-7677
Ermine, KY 41815 Fax: (606) 632-2626
Email: joelbeverly@hotmail.com

SCALE:

1"=50"

Leslie County, Kentucky.

10/14/05



Appendix F

Stream Compensation Ratio Calculator Forms





Pebble Count Data Sheet - Hollow Fill 2

| Project # _05.02 | Project Nam | ie <u>Carr Creek 404</u> | ļ | | |
|------------------|------------------|--------------------------|----------|------------|--|
| Stream/Drainage | Unnamed Trib. To | Carr Creek | Date | 10/6/03 | |
| GPS: N 37d14'02 | 2.4" | W 82d56'25.0' | , | , <u>.</u> | |
| County Knott | State KY | Quad Blackey | <i>'</i> | | |

| Point | Pebble | | Point | Pebble | 77 | Point | Pebble | 1/3 | Point | Pebble |
|-------|-----------|-------------|-------|-----------|---------------|-------|-----------|----------------|-------|-----------|
| (m) | size (mm) | | (m) | size (mm) | * | (m) | size (mm) | 12.5 | (m) | size (mm) |
| 0 | Sand | 4 15 144 | 26 | 138 | 7.2 . F 7. | 52 | 111 | (100) (100) | 78 | 17 |
| 1 | 13 | | 27 | 8 | 35 | 53 | 11 | (5) | 79 | 55 |
| 2 | 87 | J | 28 | 245 | 3 | 54 | 16 | | 80 | Sand |
| 3 | 90 | ., | 29 | 378 | T. | 55 | 13 | 1 | 81 | Sand |
| 4 | 161 | | 30 | 34 | 12.4 | 56 | 3 | | 82 | 100 |
| 5 | 103 | | 31 | 490 | | 57 | 12 | | 83 | 8 |
| 6 | Clay | | 32 | 60 | | 58 | Sand | 7.1 | 84 | 195 |
| 7 | 285 | | 33 | Sand | <u>ن</u> ي: ا | 59 | 325 | | 85 | 75 |
| 8 | 53 | | 34 | Clay | 3" | 60 | 15 | - | 86 | 41 |
| 9 | 290 | | 35 | Clay | | 61 | 31 | | 87 | 55 |
| 10 | 36 | | 36 | 3 | | 62 | 355 | | 88 | Sand |
| 11 | 58 | | 37 | 37 | | 63 | 23 | | 89 | 13 |
| 12 | 15 | | 38 | 1020 | | 64 | 137 | | 90 | 42 |
| 13 | Sand | | 39 | 465 | | 65 | 34 | | 91 | 62 |
| 14 | 57 | | 40 | 9 | | 66 | 91 | | 92 | 25 |
| 15 | 6 | | 41 | 90 | : | 67 | 140 | | 93 | 86 |
| 16 | 63 | | 42 | Sand | | 68 | 105 | | 94 | Sand |
| 17 | 3 | . *: | 43 | 7 | | 69 | 1. | | 95 | Sand |
| 18 | 800 | 100 | 44 | 25 | | 70 | 17 | | 96 | 33 |
| 19 | Sand | | 45 | 11 | | 71 | 405 | | 97 | 2 |
| 20 | 2 | | 46 | 68 | | 72 | 41 | | 98 | 215 |
| 21 | Sand | ¥ | 47 | 22 | | 73 | | ¥. | 99 | 9 |
| 22 | 5 | | 48 | 25 | | 74 | | | 100 | 21 |
| 23 | 87 | | 49 | 50 | | 75 | 34 | ** | | |
| 24 | 105 | | 50 | 125 | | 76 | 46 | | | |
| 25 | 46 | | 51 | 87 | | 77 | | ्र हर्ग | | |



Cross Section Data Sheet - Hollow Fill 2 22.9m

| Projec | Project # 05.02 Project Name Carr Creek 404 | | | | | |
|--------|---|-----------|----------------------------|--|--|--|
| - | | | To Carr Creek Date 10/8/03 | | | |
| | N 37d14'02.1" | | W 82d56'24.2" | | | |
| Count | y Knott | State KY | Quad Blackey | | | |
| Featur | re Surveyed | X riffle | pool | | | |
| Point | Distance | Elevation | Description | | | |
| | from LB (ft) | (ff) | | | | |
| 1 | 0'0" | 97.55 | | | | |
| 2 | 6'3" | 93.50 | Top of Bank | | | |
| 3_ | 6'7" | 93.20 | Bankfull | | | |
| 4 | 7'8" | 92.55 | Channel Dry | | | |
| 5_ | 9'4" | 92.35 | Thalwag | | | |
| 6 | 12'4" | 92.60 | Channel Dry | | | |
| 7 | 14'1" | 93.80 | Top of Bank | | | |
| 8 | 16'10" | 94.95 | | | | |
| 9 | 26'8" | 95.85 | | | | |
| 10 | 32'8" | 99.45 | | | | |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
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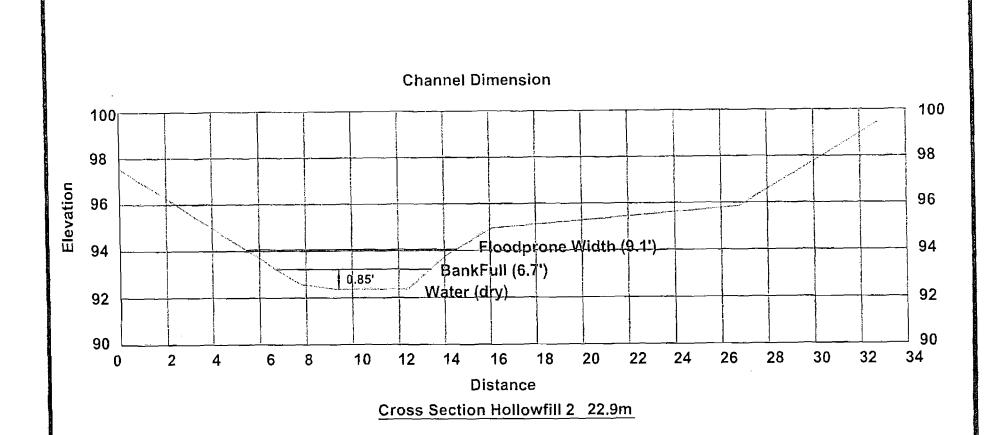
25



Cross Section Data Sheet - Hollow Fill 2 89.0m

| Project # 05.02 Project Name Carr Creek 404 | | | | | |
|---|---------------------|--|------------------------------|--|--|
| Stream | m/Drainage <u>U</u> | Innamed Trib | . To Carr Creek Date 10/8/03 | | |
| GPS: | N 37d14'00.5" |) | W 82d56'23.1" | | |
| Count | y Knott | State KY | Quad Blackey | | |
| Featur | re Surveyed | X riffle | e pool | | |
| Point | Distance | Elevation | Description | | |
| | from LB (ft) | A DESCRIPTION OF A PROPERTY OF | | | |
| 1_ | 0'0" | 98.90 | | | |
| 2_ | 4'2" | 96.90 | | | |
| 3 | 6'9" | 96.50 | Top of Bank | | |
| 4 | 8'4" | 94.85 | Bankfull | | |
| 5 | 9'6" | 94.17 | Channel Dry | | |
| 6 | 13'3" | 94.37 | | | |
| 7 | 15'7" | 93.86 | Thalwag | | |
| 8 | 18′7" | 95.10 | Channel Dry | | |
| 9 | 21'3" | 96.63 | Top of Bank | | |
| 10 | 27'9" | 95.00 | | | |
| 11 | 32'0" | 95.32 | · | | |
| 12 | 35'6" | 94.78 | Top of Bank | | |
| 13 | 38'1" | 92.50 | Bankfull | | |
| 14 | 38'7" | 92.05 | Channel Dry | | |
| 15 | 41'0" | 90.20 | Thalwag | | |
| 16 | 42'11" | 92.00 | Channel Dry | | |
| 17 | 44'3" | 94.55 | Top of Bank | | |
| 18 | 47'0" | 96.20 | | | |
| 19 | | : | | | |
| 20 | | | | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | | | | | |
| 21 | | | | | |

25



ENVIRONMENTAL CONSULTANTS, LLC

P.O. Box 338 Tel: (606) 633-7677
Ermine, KY 41815 Fax: (606) 632-2626
Email: joelbeverly@hotmail.com

nally & Hamilton enterprises, inc.

Riffle Cross Section at Unnamed Trib. to Carr Creek Lake Knott County, Kentucky

SCALE:

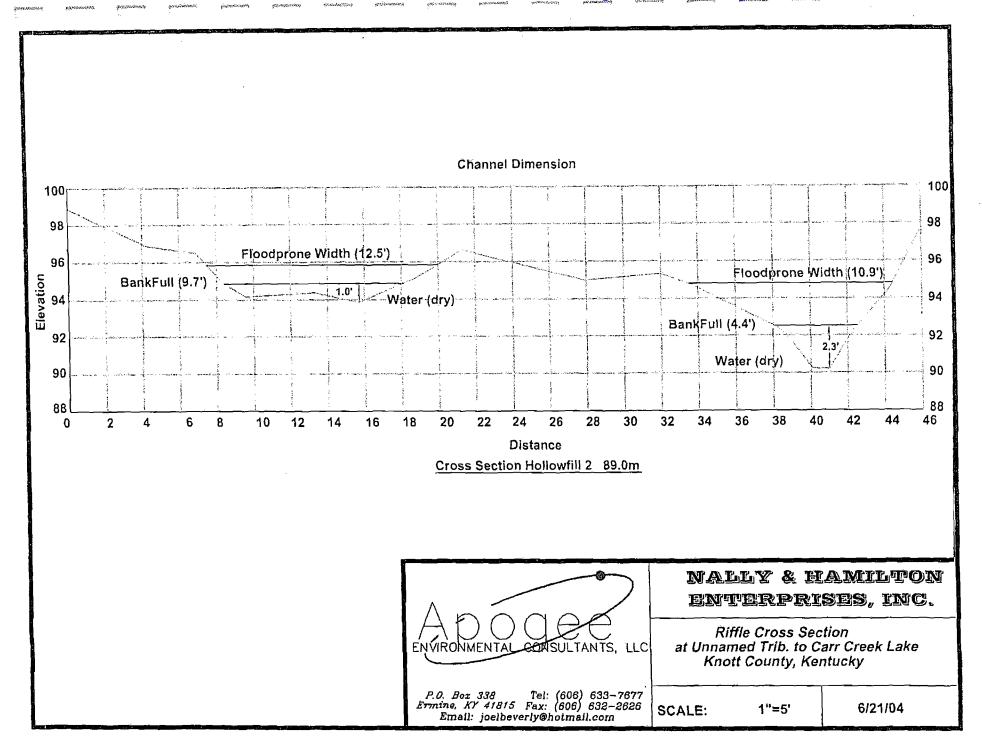
1"=4"

6/21/04



Cross Section Data Sheet - Hollow Fill 2 46.0m

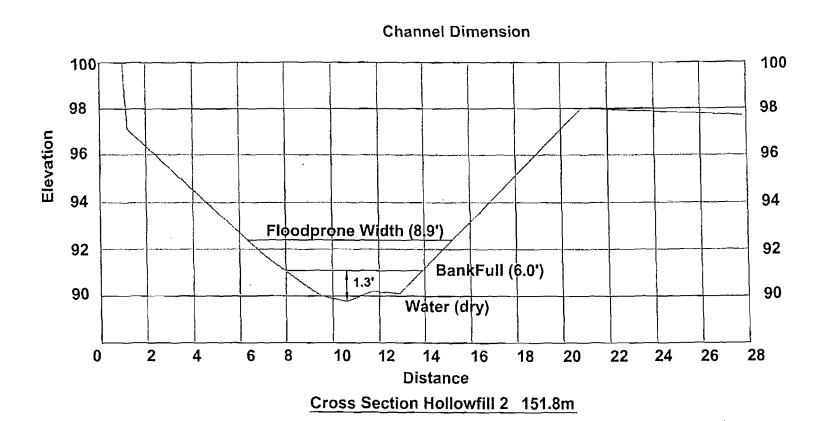
| Project # U5.U2 Project Name Carr Creek 4U4 | | | |
|--|--------|-------|-------------------|
| Stream/Drainage Unnamed Trib. To Carr Creek Date 10/8/03 | | | |
| GPS: N 37d14'01.6" W 82d56'23.6" | | | |
| County Knott State KY Quad Blackey | | | |
| Feature Surveyed | | | |
| Point | | | Description |
| | | | |
| 1 | 0'0" | 99.62 | |
| 2 | .6'8" | 95.18 | Small Channel Dry |
| 3 | 10'5" | 94.55 | Thalwag |
| 4 | 12'6" | 95.46 | Top of Bank |
| 5 | 16'10" | 95.51 | |
| 6 | 20'3" | 94.61 | |
| 7 | 28'8" | 93.95 | Top of Bank |
| 8 | 31'8" | 90.02 | Thalwag |
| 9 | 33'6" | 90.07 | Middle Channel |
| 10 | 36'3" | 90.80 | Channel Dry |
| 11 | 37'0" | 91.46 | Bankfull |
| 12 | 39'0" | 95.30 | Top of Bank |
| 13 | 44'0" | 98.00 | |
| 14 | | | |
| 15 | · | | |
| 16 | | | |
| 17 | | | |
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| 19 | | | |
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| 24 | | | |
| 25 | | | |





Cross Section Data Sheet - Hollow Fill 2 151.8m

| Projec | ct# 05.02 | Project N | lame Carr Creek 404 |
|--------|---------------|--|------------------------------|
| - | | | . To Carr Creek Date 10/8/03 |
| GPS: | N 37d13'59.4" | , | W 82d56'21.2" |
| Count | y Knott | State KY | Quad Blackey |
| | re Surveyed | riffle | |
| | Distance | ــــــــــــــــــــــــــــــــــــــ | · |
| Point | from LB (ft) | (ft) | Description |
| 1 | 0'9" | 100.00 | , |
| 2 | 1'2" | 97.10 | |
| 3 | 6'10" | 91.90 | Top of Bank |
| 4 | 7'11" | 91.10 | Bankfull |
| 5 | 9'5" | 89.95 | Edge of Water . |
| 6 | 10'6" | 89.77 | Thalwag |
| 7 | 11'7" | 90.20 | Edge of Water |
| 8 | 12'9" | 90.11 | Channel |
| 9 | 20'9" | 98.00 | Top of Bank |
| 10 | 27'8" | 97.70 | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | : |
| 16 | | | |
| 17 | | | |
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| 25 | ì | ļ | |





NALLY & HAMILTON ENTERPRISES, INC.

Pool Cross Section at Unnamed Trib. to Carr Creek Lake Knott County, Kentucky

SCALE:

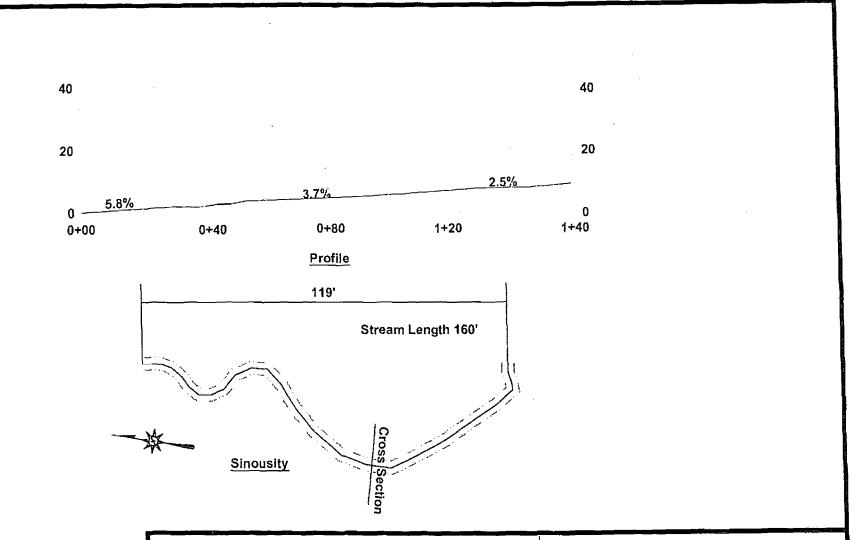
1"=4"

6/21/04

Appendix D

Longitudinal Profile, Cross Sections, and Pebble Counts for Streams to be Disturbed at Proposed Project Area





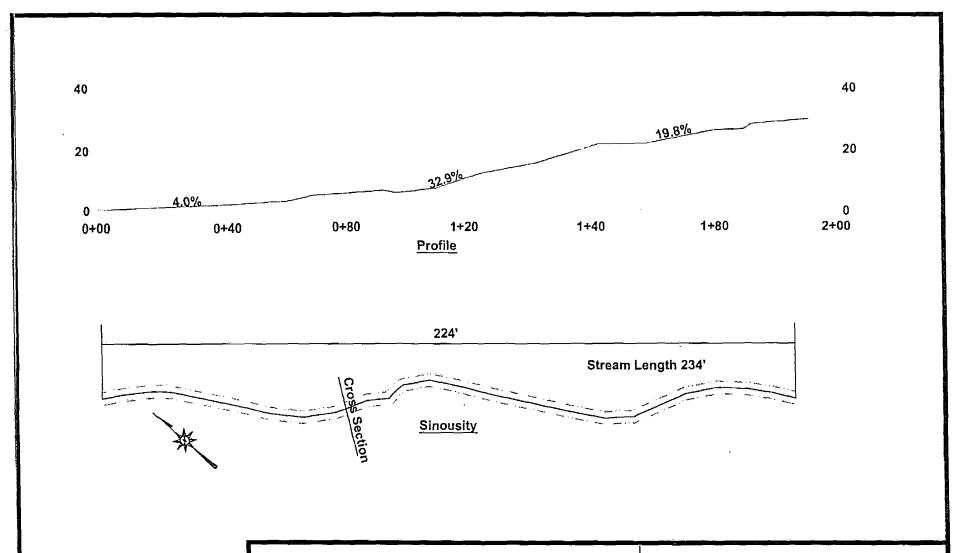


nally & Hamilton Enterprises, inc.

Longitudinal Profile of Pond 107-A5 Knott County, Kentucky.

SCALE:

1"=30"



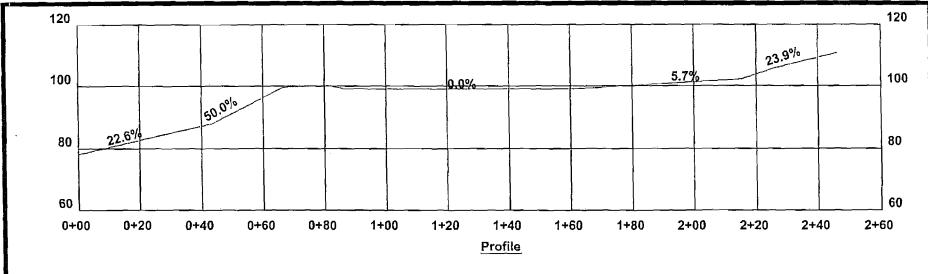


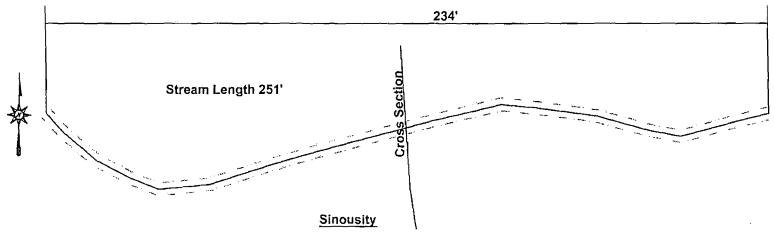
nally & Hamilton Enterprises, inc.

Longitudinal Profile of Hollow Fill 16-A5 Knott County, Kentucky.

SCALE:

1"=30"





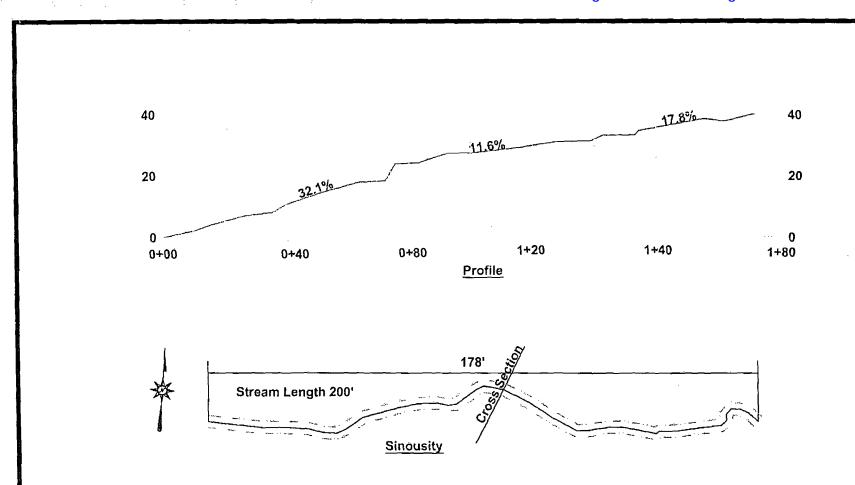


nally & Hamilton Enterprises, inc.

Longitudinal Profile of Pond 106-A5 Knott County, Kentucky.

SCALE:

1"=30"



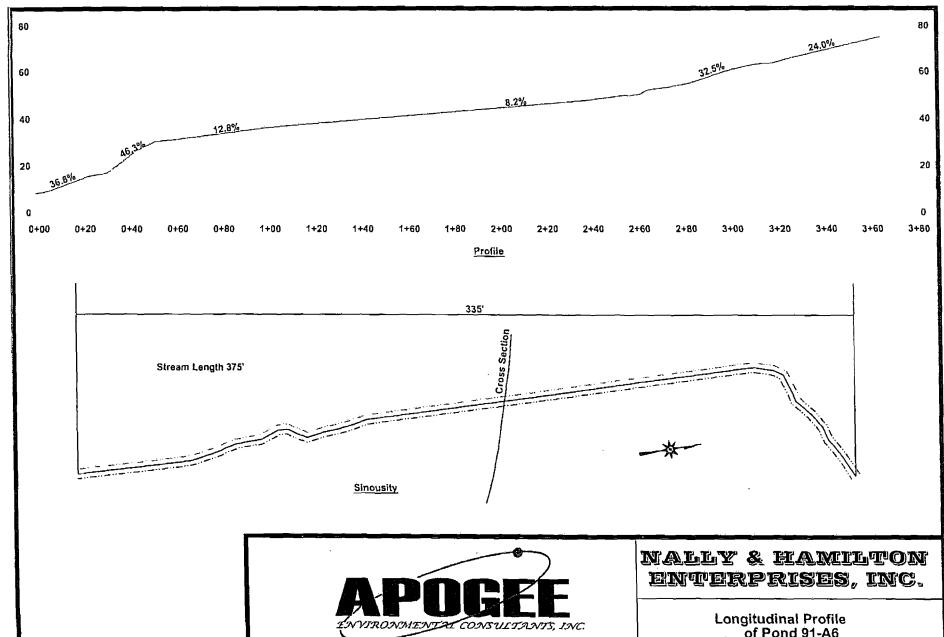


NALLY & HAMILTON ENTERPRISES, INC.

Longitudinal Profile of Hollow Fill 15-A5 Knott County, Kentucky.

SCALE:

1"=30"



Longitudinal Profile of Pond 91-A6 Knott County, Kentucky.

SCALE:

1"=40"



Sinousity

P.O. Box 338 Tel: (606) 633-7677

Ermine, KY 41815 Fax: (608) 632-2626

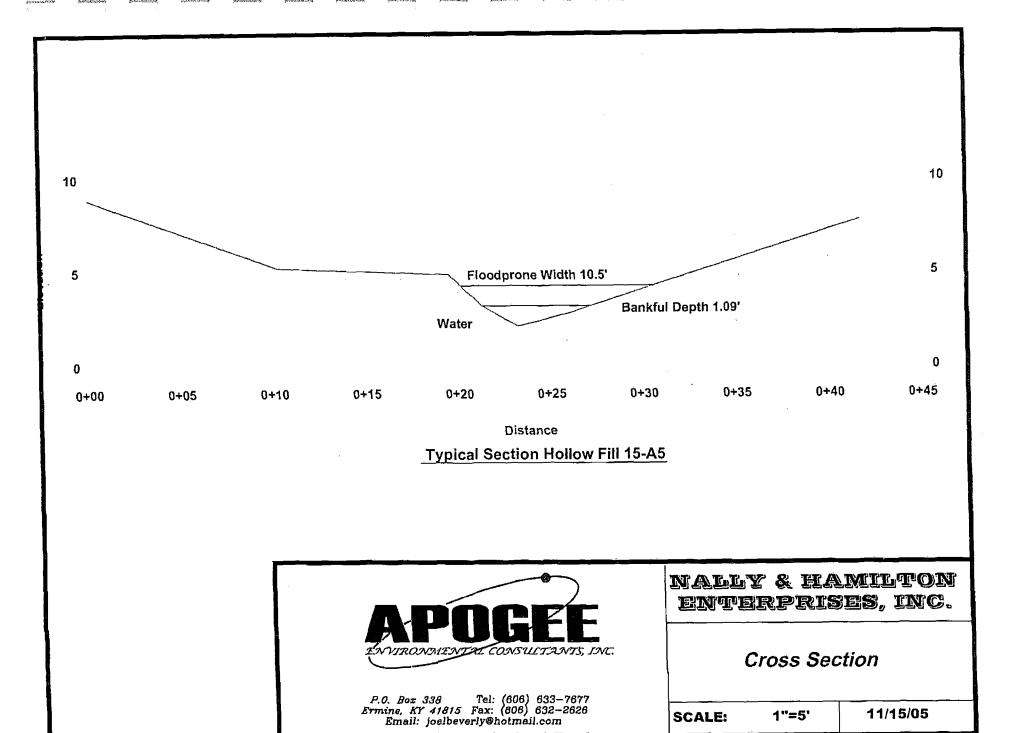
Email: joelbeverly@hotmail.com

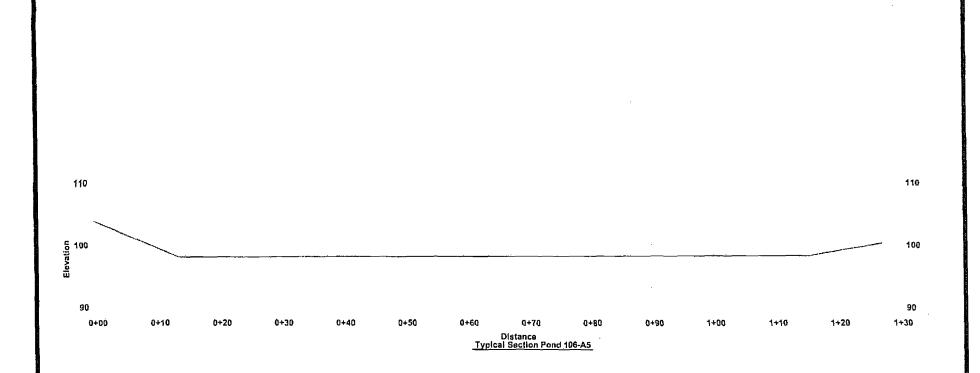
nally & Hamilton Enterprises, inc.

Longitudinal Profile of Hollow Fill 17-A6 Knott County, Kentucky.

SCALE:

1"=40"





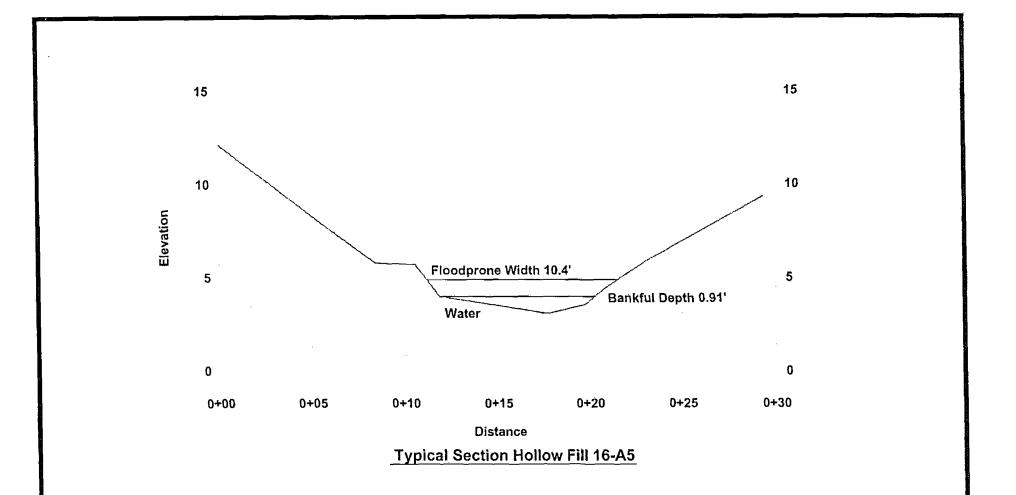


NALLY & HAMILTON ENTERPRISES, INC.

Cross Section

SCALE:

1"=15'



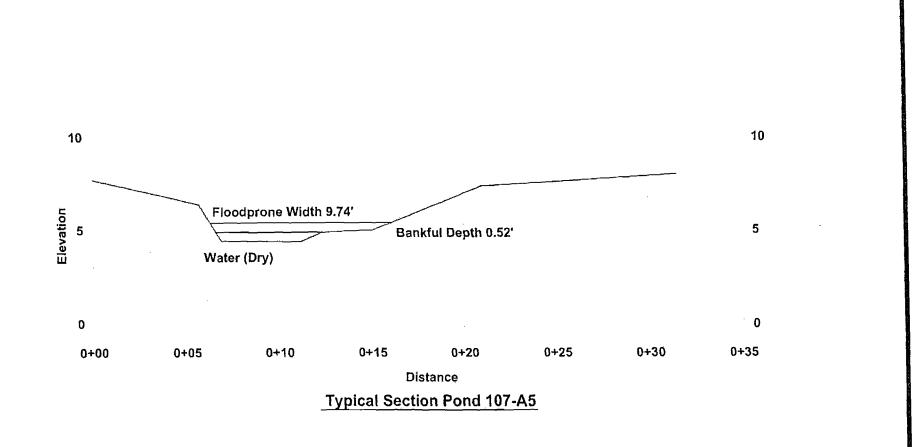


NALLY & HAMILTON ENTERPRISES, INC.

Cross Section

SCALE:

1"=5"





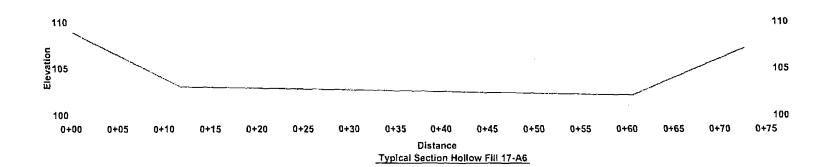
NALLY & HAMILTON ENTERPRISES, INC.

Cross Section

SCALE:

1"=5"

Case: 6:14-cv-00055-DLB Doc #: 2-4 Filed: 03/07/14 Page: 122 of 131 - Page ID#: 230





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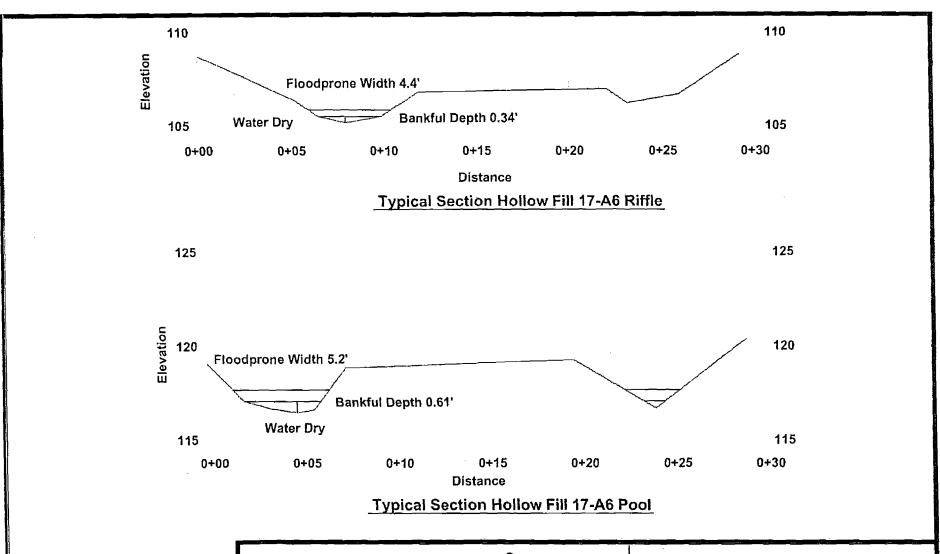
Email: joelbeverly@hotmail.com

NALLY & HAMILTON ENTERPRISES, INC.

Cross Section

SCALE:

1"=15'





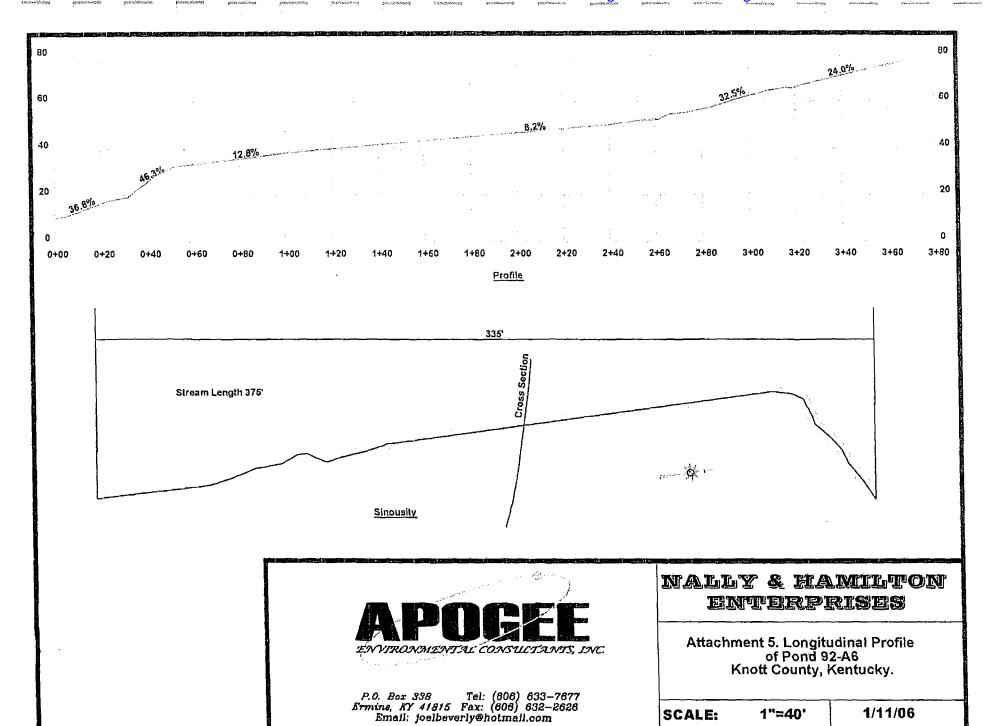
NALLY & HAMILTON ENTERPRISES, INC.

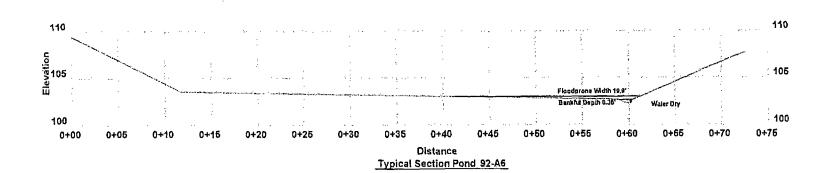
Cross Section

SCALE:

1"=5"

Case: 6:14-cv-00055-DLB Doc #: 2-4 Filed: 03/07/14 Page: 124 of 131 - Page ID#: 232







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NALLY & HAMILTON ENTERPRISES

Cross Section

Amendment 5

SCALE:

1"=15"

02/28/2005 15:54

6066423258

CELRL OP CARR CREEK

PAGE 01

| Stream Channel Classification (Level II) |
|---|
| Show NAME: UNNAMED TREB TO DEFENTED CREEK |
| Basin NAME: IFF 15-A5 Drainage AREA: 50.6 acre mi ² Location: (ARR FORK (AKF |
| Twp: Rge: See: Qtr: Lat: Long: Observers: Date: 11-10-05 |
| Bankfull WIDTH (Wold) 5,92 Feet WIDTH of the stream channel, at bankfull stage elevation, in a riffle section. |
| Mean DEPTH (dut) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section. (dut=Aut;West) |
| Bankfull Cross Section Area (Abb) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section. |
| WIDTH / DEPTH RATIO (What /dolar) 8, 7/ Ft/Ft . Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section. |
| Maximum DEPTH (d _{rabki}) Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and thalweg elevations, in a tiffle section. |
| WIDTH of Flood-Prone Ares (W _{flos}) Twice maximum DEPTH, or (2 x d _{mbd}) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section. |
| Entrenchment Ratio (ER) 1.77 FVF1 The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH. (Wp./Wat.) (riffle section) |
| Channel Materials (Particle Size Index) D50 The D50 particle size index represents the mean diameter of channel materials, as sampled from the channel surface, between the bankfull stage and thalwag elevations. |
| Water Surface SLOPE (S) Channel slope = "rise over run" for a reach approximately 20 ~ 30 bankfull channel widths in length, with the "fiffle to riffle" water surface slope representing the gradient at bankfull stage. |
| Channel SINUOSITY (K) Simuosity is an index of channel pattern, determined from a ratio of stream length divided by valley length (SL/VL); or estimated from a ratio of valley slope divided by channel slope (VS/S). |
| Stream Type Stream Type Roegen, 1990. Applied River Morphology, |



Pebble Count Data Sheet

| Project # Project N | lame <u>860-0380 ADM #5</u> |
|---------------------------|------------------------------|
| Stream/Drainage WANTED 78 | LE DEFENTE CIC Date 11-10-05 |
| GPS: N 37° 13′ 50,7" | W 83°01'58.1" |
| County KNOFT State 12 | V Quad BLACKEV |

| Point | Pebble | | Point | Pebble | χ. | Point | Pebble | 77 | Point | Pebble |
|-------|-------------|---|-------|------------|---------------------------------------|-------|-----------|-----------------|------------------------|-----------|
| (m) | size (mm) | | (m) | size (mm) | | (m) | size (mm) | 10.72 | Transfer in the second | size (mm) |
| 0 | 152 | | 26 | 12 | | 52 | | 13.5 | 78 | |
| 1 | 42 | | 27 | 76 | 1 2 3 | 53 | | v | 79 | |
| 3 | 5 | | 28 | 2,2 | | 54 | | | 80 | |
| | 204 | | 29 | 1700 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | _ 55 | | | 81 | |
| 4 | 444 | | 30 | 326 | | 56 | | | 82 | |
| 5 | 213 | | 31 | 128 | | 57 | | | 83 | |
| 6 | 32 | | 32 | 35 | | 58 | | | 84 | |
| 7 | 1 | | 33 | 820 | | 59 | | ®/see } er′n | 85 | |
| 8 | SICT | | 34 | 14 | \ | 60 | _ | | 86 | |
| 9 | 45 | | 35 | SECT | 1935. 1 | 61 | | | 87 | |
| 10 | 293 | | 36 | 213 | | 62 | | | 88 | |
| 11 | 11 | | 37 | 66 | ٠., | 63 | | | 89 | |
| 12 | 445 | | 38 | 17 | | 64 | | | 90 | |
| 13 | 32 | | 39 | 86 | | 65 | | 30. *** 7 | 91 | |
| 14 | 29 | , f | 40 | 46 | 50 12. | 66 | | * : ::: | 92 | |
| 15 | 3 | 1 | 41 | <i>525</i> | | 67 | | | 93 | |
| 16 | 102 | | 42 | 52 LT | | 68 | | | 94 | |
| 17 | 34 | | 43 | 634 | | 69 | | | 95 | |
| 18 | ଞ <u>୍ଚ</u> | 2.3 | 44 | 78 | | 70 | | | 96 | |
| 19 | 7€ | | 45 | 1100_ | | 71_ | | | 97 | |
| 20 | 40 | | 46 | 96 | | 72 | | | 98 | |
| 21 | 489 | | 47 | 163 | | 73 | | | 99 | |
| 22 | 172 | | 48 | 163 | | 74 | | | 100 | |
| 23 | Brul DER | | 49 | 794 | . [| 75 | | I | | |
| 24 | 28 | | 50 | 32 | | 76 | | | | |
| 25 | SAND | <u>. </u> | 51 | | ٠., | 77 | | | | |



Longitudinal Profile Data Sheet - HOLLOW FILL 15-AS

| Project # Pro | ect Name | 860 | - 0380 ADM + | 5 |
|---------------------------|----------|---------------|--------------|----------|
| Stream/Drainage Unique 6. | O TRIB | <u>DE FEA</u> | TED CK Date | 11-10-05 |
| GPS: N 37° 13′ 50.7" | | w | 83°01'58.1" | |
| County LNOTT State | KU | Quad | BLACKEY | |

| Point | Distance | Elevation | Stream | Water depth | Bankfull |
|-------|--------------|-------------------------------|------------------|-------------------------|-------------|
| | from Beg(ft) | (ft) | Characteristic | (Tenths) | (Tenths) |
| 1 | O O | | | <u> </u> | (renuis) |
| 2 | 9,7 | 72.0 | KIFTLE | 1/21/ | |
| 3 | | 72.0 | Pool | D2 y | |
| | 15,1 | 73,9 | PEFFLE REFFLE | V | |
| 4 | 26.6 | 76.9 | rirric | DRY Y" DRY DRY | |
| 5 | 35.4 43,7 | <u>78.0</u> | Pool | 917 | |
| 6 | 43,7 | <u> 80.6</u> | RIFFLE | DRY | |
| 7 | 53.5 63.9 | <i>§2. 0</i> | Pro C | 2" | <u>-</u> |
| 8 | 63.7 | 85.1 | REFFEC | DR 1/ | |
| 9 | 72,2 | 97.9 | FEFFLE | 1 | |
| 10 | 75.6 83.0 | 97.9 88.3 93.8 94. 2 | FriL | | |
| 11 | 83.0 | <u>93.8</u> | RSFFLE | | 6 |
| 12 | 92,5 | 94.2 | RIFFLE | | |
| 13 | 100.0 | 97.3 | RIFFLE | | |
| 14 | 115, 1 | 97.3 | rool | | |
| 15 | 127.5 | 39,1 | RIFILE | | |
| 16 | 138.9 | 100,9 | REFFLE | | |
| 17 | 142.6 | 101.3 | POUL | | |
| 18 | 153,0 | 102,9 | RIFILE | | |
| 19 | 154,4 | 103.2 | Fool | | |
| 20 | 175,7 | 104.5 | RIFFLE | | |
| 21 | 182,0 | 10 E. 3 | REFFLE | Ą | |
| 22 | 191,7 | 108.3 | POOL | DRY | 6 |
| 23 | | | | 7 | |
| 24 | | | | | |
| 25 | | | | | |
| 26 | | | | | |
| 27 | | | | | · - |
| 28 | | | ` | | |
| 29 | | 7 | | | |
| 30 | | | | | |



Cross Section Data Sheet -Hollow FILL 15-A5

| Projec | t# | Project N | lame 8€0-0380 AOM = 5 |
|--------|--------------------------|-------------------|-------------------------------|
| | | | RED DEFEATED IK Date 11-10-05 |
| GPS: N | 1 37° 13' 9 | 50.7" | W 83°01'581" |
| County | 1 KNOTT | _ State <u>K</u> | V Quad Blackey |
| Featur | e Surveyed | rifflé | Quad <u>B(4(KEY</u> |
| Point | Distance from LB (ft) | Elevation (ft) | Description |
| 1 | 0 | 104.2 | HILL |
| 2 | 10,25 | | BOTTOM OF BANK |
| 3 | 19,46 | (00, 2 | TOP OF BANK |
| 4 | 21,28 | 98,5 | BANKFUL/ CHANNEL |
| 5 | 23.22 | 97,4 | THALLE G |
| 6 | 26.11 | 98.1 | CHANCEL |
| 7 | 30,94 | <i>99,7</i> | TOP OF BANK |
| 8 | 41,70 | 103.1 | HELL |
| 9 | | | |
| 10 | | | |
| 11 | | | ' |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |

24 25

| Stream Channel Classification (Level II) | |
|--|---------------------------------------|
| Stream NAME: SULAR BRANCH | |
| Basin NAME: HF 16-A5 Drainage AREA: 56.5 acre | mi² |
| Locations (ARR FORK COVE | - |
| | Long: |
| | atex 11-10-05 |
| Observers: Di | |
| Bankfull WIDTH (Wbk) | 8.44 Feet |
| WIDTH of the stream channel, at bankfull stage elevation, in a riffle section. | <u> </u> |
| | |
| the construction of the second section in the second secon | |
| Mean DEPTH (d _{bki}) | 6.55 Feet |
| Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section. | |
| (dut-Aud Ward) | |
| Bankfull Cross Section Area (Abb) | 4; 2 Feet ² |
| AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section. | *** |
| | |
| | |
| WIDTH / DEPTH RATIO (What /down) | 15,35 FUFE |
| Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section. | `. |
| | · |
| Maximum DEPTH (d _{mbkl}) | 0,9 Feet |
| Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and | · · · |
| thatweg elevations, in a riffle section. | |
| | |
| WIDTH of Flood-Prone Area (Wana) | 10.4 Feet |
| Twice maximum DEPTH, or (2 x ducket) = the stage/elevation at which flood-prone area WIOTH is | |
| determined in a riffle section. | , and the second second |
| Entrenchment Ratio (ER) | 1.2 3 FVFt |
| The ratio of flood prone area WIDTH divided by bankfull channel WIDTH. (Win/Win) (niffle | |
| section): | |
| | |
| Channel Materials (Particle Size Index) D50 | |
| The D50 particle size index represents the mean diameter of channel materials, as sampled from the | |
| channel surface, between the bankfull stage and thalweg elevations. | |
| The of the OT ONE OF | 18.9 FUFT.% |
| Water Surface SLOPE (5) Channel slope = "rise over run" for a reach approximately 20 - 30 bankfull channel widths in length, | · · · · · · · · · · · · · · · · · · · |
| with the "fiffle to riffle" water surface slope representing the gradient at bankfull stage. | |
| とうとうないとうないととなるとのないというないというというというというというというというというというというというというという | |
| | 1,04 |
| Sinuosity is an index of channel pattern, determined from a ratio of stream length divided by valley | |
| length (SL/VL); or estimated from a ratio of valley slope divided by channel slope (VS/S). | |
| For Reference, see | page 5-5, 5-4: |
| | River Morphology |

| Stream Channel Classification (Level II) |
|--|
| Stram MAME: SUGAR BRANCH |
| Basin NAME: POND 107-A5 Drainage AREA: 70.9 acre mi ² |
| Locations (ARR: CREEK |
| Twp: Rge See Qtr. Lat' Long. |
| Observers: Date: 11-10-0-5 |
| |
| Bankfull WIDTH (Wold) 5,74. Feet |
| WIDTH of the stream channel, at bankfull stage elevation, in a riffle section. |
| |
| Mean DEPTH (dua) 0.39 Feet |
| Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section. |
| (du-Au Win) |
| Bankfull Cross Section Area (And) 2.48 Foot ² |
| AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section. |
| |
| THE TO DESCRIPTION OF THE PARTY |
| WIDTH / DEPTH RATIO (Wbkf/dbkd). 14,72 FUFt Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section. |
| English with divided by balletin mean perfitting marning section. |
| |
| Maximum DEPTH (d _{mbkt}) <u>0.52</u> Feet |
| Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and that were elevations, in a riffle section. |
| gg uniweg cievations, in a time section. |
| WIDTH of Flood-Prome Area (W _{flat}) 9.7 4 Feet |
| Twice maximum DEPTH, or (2 x dubk) = the stage/elevation at which flood-prone area WIDTH is |
| determinel in a riffle section. |
| Entrenchment Ratio (ER) |
| The ratio of flood prone area WIDTH divided by bankfull channel WIDTH. (WordWate) (riffle |
| section) |
| |
| Channel Materials (Particle Size Index) D50 The D50 particle size index represents the mean diameter of channel materials, as sampled from the |
| channel surpice between the psykfull stage and thalwes elevations |
| |
| Water Surface SLOPE (S) |
| Channel slope = "rise over run" for a reach approximately 20 - 30 bankfull channel widths in length, |
| with the "niffle" to riffle" water surface slope representing the gradient at bankfull stage. |
| Channel SINUOSITY (K) |
| Simonity is an index of channel pattern, determined from a ratio of stream length divided by valley |
| length (SL/VL); or estimated from a ratio of valley slope divided by channel slope (VS/S). |
| |
| Stream Type For Reference, see page 5-6, 6-6: Rossen, 1996, Applied River Marphotogy, |